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International Centre for Theoretical Physics, Trieste

Scientific activities in 1995

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PART I

INTRODUCTION

The 60 courses, 12 research activities, 1 training scheme and 1 lecture series that the International Centre for Theoretical Physics organized in 1995 totalled about 5,900 visits, 60% of which by scientists from developing countries.

The organization of this unprecedented number of activities with a record number of visits was made possible by the regular contributions from IAEA (US$1,703,300), UNESCO (US$373,500) and the Italian Government (US$12,195,000), plus by extraordinary contributions, mainly by the Italian Government, United Nations University, Department for Research Cooperation SAREC of the Swedish International Development Cooperation Agency (SIDA), and European Commission. Numerous other institutions were co-sponsors of the training-for-research activities.

STATISTICAL DATA

Table 1 and Table 2 show the number of individuals, i.e. *visitors*, who took part in the training and research activities of ICTP in 1995. The total length of stay is expressed in terms of *person–months.*

Table 1
1995 vs. 1994

	VISITORS		PERSON-MONTHS		TOTAL		PERCENTAGE (Dev. vs. total)	
	Dev.	Adv.	Dev.	Adv.	Visitors	P–M	Visitors	P–M
1995	2253	2000	3546.6	1186.76	**4253**	**4733.36**	52.97%	74.93%
1994	2050	1570	3213.44	1051.21	**3620**	**4264.65**	56.63%	75.35%
Approx. increase percent:								
%	*+ 9 00*	*+ 22 00*	*+ 10 28*	*+ 12 00*	*+ 15 00*	*+ 9 50*		
Figures for 1995 include:								
1995	96	1	500.48	0.07	**97**	**500.55**	99.99%	0.01%
Figures for 1994 include:								
1994	83	5	461.42	0.31	**88**	**461.73**	94.31%	99.93%

Numbers and percentages are given for the year 1995 versus 1994. The total number of visitors in 1995 reached 4,253 against 3620 of 1994 with an increase of 15%. Out of 4,253, 2,253 (52.97%) were from developing countries against 2,050 of 1994 with an increase of 9%. The total length of stay was 4,733 months (75% accounted for by developing countries). The length of stay by scientists from developing countries increased by 10%. Figures for 1994 and 1995 include the number of scientists present in Italian Laboratories for training and research.

Table 2
Participation by geographical area

Geographical area	Visitors		Person-months		Total	
	Dev.	Adv.	Dev.	Adv.	Visitors	P-months
Africa	398	0	763.59	0.00	398	763.59
Asia	725	88	1366.80	36.99	813	1403.79
Europe	797	1462	875.93	725.38	2259	1601.31
Indonesia and Oceania	8	8	13.86	3.02	16	16.88
North and Central America	68	355	115.75	183.86	423	299.61
South America	257	0	410.67	0.00	257	410.67
International Organizations	0	87	0.00	237.51	87	237.51
TOTAL	**2253**	**2000**	**3546.6**	**1186.76**	**4253**	**4733.36**
Developing vs. Total (%)					**52.97%**	**74.93%**

This table shows breakdowns by geographical area on the number of ICTP visitors with totals for developing and advanced countries and their length of stay. The above figures deal with training and research activities combined.

Table 3
Visitors and Person-months by Country

DEVELOPING COUNTRIES

AFRICA	Visitors	P-M
ALGERIA	31	79.16
ANGOLA	1	0.30
BENIN	7	10.94
BURKINA FASO	2	0.63
BURUNDI	3	3.39
CAMEROON	8	23.24
CAPE VERDE ISLANDS	2	0.52
CENTRAL AFRICAN REP.	1	0.69
CHAD	1	0.36
COMORO ISLANDS	1	0.39
CONGO	1	0.69
CÔTE D'IVOIRE	5	10.14
EGYPT	61	95.26
EQUATORIAL GUINEA	1	0.30
ERITREA	1	0.72
ETHIOPIA	17	38.27
GABON	1	0.69
GAMBIA	1	0.26
GHANA	17	45.85
GUINEA	5	4.87
GUINEA-BISSAU	1	0.39
KENYA	12	18.35
LIBERIA	1	4.71
LIBYA	7	10.16
MADAGASCAR	5	9.31
MALAWI	2	6.90
MALI	6	11.83
MAURITANIA	7	14.85
MOROCCO	26	36.42
NIGER	3	1.15
NIGERIA	67	193.01
RWANDA	2	6.28
SENEGAL	11	16.26
SIERRA LEONE	1	3.58
SOUTH AFRICA	11	3.08
SUDAN	21	45.95
TANZANIA	4	4.49
TOGO	3	3.14
TUNISIA	12	8.85
UGANDA	5	5.40
ZAIRE	10	30.98
ZAMBIA	5	5.72
ZIMBABWE	9	6.11
TOTAL	**398**	**763.59**
countries represented	43	

ASIA	Visitors	P-M
BANGLADESH	31	59.22
CHINA P.R.	185	408.33
INDIA	240	449.91
IRAN	62	63.41
JORDAN	8	29.66
KOREA	38	59.22
KUWAIT	2	0.66
LEBANON	3	1.54
MALAYSIA	9	6.93
MONGOLIA	6	22.66
MYANMAR	1	15.50
NEPAL	8	32.32
OMAN	1	0.79
PAKISTAN	43	77.28
PHILIPPINES	6	11.12
SAUDI ARABIA	4	3.69
SINGAPORE	1	1.58
SRI LANKA	5	5.09
SYRIA	16	14.83
THAILAND	8	6.05
VIET NAM	39	87.52
WEST BANK	6	6.73
YEMEN A.R.	3	2.76
TOTAL	**725**	**1366.80**
countries represented	23	

Table 3
Visitors and Person-months by Country (contd.)

DEVELOPING COUNTRIES

EUROPE	Visitors	P-M
ALBANIA	18	17.68
ARMENIA	10	9.59
AZERBAIJAN	2	2.87
BELARUS	30	15.18
BOSNIA & HERZEGOVINA	10	33.69
BULGARIA	58	102.81
CROATIA	44	29.43
CZECH REPUBLIC	33	34.42
ESTONIA	3	0.72
GEORGIA	15	26.34
HUNGARY	35	29.99
KAZAKHSTAN	3	1.75
LATVIA	1	1.94
LITHUANIA	15	10.07
MACEDONIA F.r Yug. Rep.	8	3.80
MOLDOVA	5	15.18
POLAND	60	53.28
ROMANIA	70	86.15
RUSSIA	186	160.45
YUGOSLAVIA Fed. Rep.	2	0.39
SLOVAK REPUBLIC	20	31.72
SLOVENIA	47	49.61
TURKEY	67	111.76
UKRAINE	49	40.65
UZBEKISTAN	6	6.46
TOTAL	**797**	**875.93**
countries represented	25	

NORTH AND CENTRAL AMERICA	Visitors	P-M
COSTA RICA	1	0.46
CUBA	26	73.7
HONDURAS	3	3.13
JAMAICA	2	0.69
MEXICO	35	34.75
TRINIDAD & TOBAGO	1	3.02
TOTAL	**68**	**115.75**
countries represented	6	

INDONESIA AND OCEANIA	Visitors	P-M
INDONESIA	7	13.37
PAPUA NEW GUINEA	1	0.49
TOTAL	**8**	**13.86**
countries represented	2	

SOUTH AMERICA	Visitors	P-M
ARGENTINA	88	145.11
BOLIVIA	3	17.34
BRAZIL	97	154.79
CHILE	12	10.93
COLOMBIA	12	12.32
ECUADOR	1	0.16
PERU	11	21.23
URUGUAY	11	13.26
VENEZUELA	22	35.53
TOTAL	**257**	**410.67**
countries represented	9	

	VISITORS	P-M	COUNTRIES REPRESENTED
TOTALS FOR DEVELOPING COUNTRIES	**2253**	**3546.6**	**108**

Table 3
Visitors and Person-months by Country (contd.)

ADVANCED COUNTRIES AND INTERNATIONAL ORGANIZATIONS

EUROPE	Visitors	P-M
AUSTRIA	36	10.15
BELGIUM	30	9.72
DENMARK	29	16.84
FINLAND	8	2.47
FRANCE	165	57.67
GERMANY	241	75.51
GREECE	9	4 67
IRELAND	6	1.31
ITALY	581	372.03
NETHERLANDS	54	12.84
NORWAY	9	2.75
PORTUGAL	9	2.47
SPAIN	43	29.75
SWEDEN	42	31.72
SWITZERLAND	53	17.30
UNITED KINGDOM	147	78.18
TOTAL	**1462**	**725.38**
countries represented	16	

ASIA	Visitors	P-M
ISRAEL	30	10.35
JAPAN	58	26.64
TOTAL	**88**	**36.99**
countries represented	2	

NORTH AND CENTRAL AMERICA	Visitors	P-M
CANADA	12	7.63
U.S.A.	343	176.23
TOTAL	**355**	**183.86**
countries represented	2	

INDONESIA & OCEANIA	Visitors	P-M
AUSTRALIA	7	2.73
NEW ZEALAND	1	0.29
TOTAL	**8**	**3.02**
countries represented	2	

INT'L ORGANIZATIONS	Visitors	P-M
CERN	31	19.19
IAEA	26	184.91
JINR	23	20.30
Other oraganizations	7	13 11
TOTAL	**87**	**237.51**
organizations represented	7	

	VISITORS	P-M	COUNTRIES–ORG. REPR.
TOTALS FOR ADVANCED COUNTRIES	2000	1186.76	29

	VISITORS	P-M	TOTAL REPRESENTED
Developing countries	*2253*	*3546.6*	*108*
Advanced countries	*2000*	*1186.76*	*29*
GRAND TOTAL	*4253*	*4733.36*	*137*

Tables 4, 5 and 6 show the number presences — VISITS — in the training and research activities of ICTP. Figures on VISITS are higher than those of previous tables since many visitors took part in more than one activity. Percentages refer to the TOTAL NUMBER OF VISITS in the field vs. the GRAND TOTAL.

Table 4

Visits by scientific field

Field	Number of visits				Number of Person-months			
	Dev.	Adv.	Total	%	Dev.	Adv.	Total	%
Condensed matter physics	990	758	1748	29.79%	784.88	273.73	1058.61	22.36%
High and intermediate energies	663	668	1331	22.69%	738.30	409.59	1147.89	24.25%
Mathematics	391	220	611	10.41%	557.41	130.93	688.34	14.54%
Physics and energy	113	26	139	2.37%	68.76	5.60	74.36	1.57%
Physics of the environment	259	175	434	7.40%	217.68	139.35	357.03	7.54%
Physics of the living state	196	154	350	5.97%	69.20	35.41	104.61	2.21%
Applied physics and high tech.	421	298	719	12.25%	293.23	86.87	380.10	8.03%
Miscellaneous	364	74	438	7.47%	316.66	105.21	421.87	8.91%
TOTAL	**3397**	**2373**	**5770**		**3046.12**	**1186.69**	**4232.81**	
Outside activities	96	1	97	1.65%	500.48	0.07	500.55	10.57%
GRAND TOTAL	**3493**	**2374**	**5867**		**3546.60**	**1186.76**	**4733.36**	

This table shows breakdowns of visits in the scientific fields of ICTP and percentages of participation for such fields vs. the grand total. In this table, the numbers on scientists present in Italian Laboratories are also included.

Table 5

Visits by type of activity

Type of activity	Number of Visits			Number of Person-months		
	Dev.	Adv.	**Total**	Dev.	Adv.	**Total**
a) Research						
Condensed matter physics	130	29	**159**	217.33	59.08	**276.41**
Physics of high and intermediate energies	169	74	**243**	277.92	186.79	**464.71**
Mathematics	107	24	**131**	289.66	46.02	**335.68**
Plasma physics	14	7	**21**	51.99	17.61	**69.60**
Aeronomy and Radiopropagation Laboratory	19	10	**29**	41.04	2.32	**43.36**
Structure and nonlinear dynamics of the Earth	34	15	**49**	85.89	83.63	**169.52**
Climate and Global Change Group	0	2	**2**	0.00	4.67	**4.67**
Microprocessor Laboratory	7	3	**10**	6.55	19.48	**26.03**
HTC Superconductivity Laboratory	9	1	**10**	31.45	11.70	**43.15**
Laboratory for lasers and optical fibres	15	2	**17**	39.66	0.69	**40.35**
Digital communications and computer networking	7	2	**9**	11.19	15.15	**26.34**
Science, high technology and development	1	4	**5**	0.97	0.10	**1.07**
Other	132	33	**165**	74.36	176.22	**250.58**
TOTAL	644	206	**850**	1128.01	623.46	**1751.47**
Total vs. Grand Total (%)	18.44%	8.68%	14.49%	31.81%	52.53%	37.00%
b) Training activities						
TOTAL	2753	2167	**4920**	1918.11	563.23	**2481.34**
Total vs. Grand Total (%)	78.81%	91.28%	83.86%	54.08%	47.46%	52.42%
c) Visits to Italian Laboratories						
TOTAL	96	1	**97**	500.48	0.07	**500.55**
Total vs. Grand Total (%)	2.75%	0.04%	1.65%	14.11%	0.01%	10.57%
GRAND TOTAL	**3493**	**2374**	**5867**	**3546.60**	**1186.76**	**4733.36**

This table shows breakdowns by type of activity: research, training courses and outside activities. Numbers deal with the following categories of scientists: Visiting scientists, Associate Members, Affiliates as well as course directors, course lecturers and participants.

Table 6

Visits by activity

This table shows breakdowns by activity and field. Totals are given for developing and advanced countries in each activity held in 1995, showing the number of scientists as well as the amount of training received expressed in person-months. Percentages refer to the total participation of each field vs. the grand total.

Field and Course Name	Dates	Number of Visits			No. of Person-months		
		Dev.	Adv.	Total	Dev.	Adv.	Total
PHYSICS OF CONDENSED MATTER							
Research in physics of condensed matter	All year	130	29	**159**	217.33	59.08	**276.41**
Diploma course in condensed matter physics (1)	3 Jan–29 Sep	17	2	**19**	96.69	1.58	**98.27**
Seventh International workshop on computational condensed matter physics	11–15 Jan	12	168	**180**	2.15	25.94	**28.09**
Workshop on the physics of semiconductor microstructures and ARC on semiconductor systems (2)	13–24 Feb	87	15	**102**	31.30	5.40	**36.70**
Third ESF workshop: Network on quantum fluids and solids "Excitations and spin-polarised systems"	20–26 Apr	15	58	**73**	4.68	14.39	**19.07**
College on computational physics	15 May–9 Jun	77	16	**93**	72.42	7.79	**80.21**
Workshop on computational methods in material science and engineering	12–23 Jun	50	30	**80**	20.33	8.28	**28.61**
Research workshop on condensed matter physics	12 Jun–18 Aug	234	96	**330**	196.51	68.43	**264.94**
Adriatico Research Conference on Physics of sliding friction	20–23 Jun	8	53	**61**	1.44	9.16	**10.60**
Miniworkshop on "Quantum incoherence and quantum coherence in strongly correlated systems"	3–21 Jul	60	75	**135**	26.06	26.12	**52.18**
Adriatico Research Conference on Chaos in atoms and molecules	18–21 Jul	19	31	**50**	4.95	5.23	**10.18**
African regional workshop on parallel processing and its applications (3)	31 Jul–11 Aug	59	2	**61**	23.04	0.78	**23.82**
Miniworkshop on Josephson junction arrays	7–11 Aug	38	46	**84**	7.25	8.28	**15.53**
Workshop on nonlinearity: Noise in nonlinear systems	14–25 Aug	51	21	**72**	22.6	6.51	**29.11**
Adriatico Research Conference on contemporary concepts in condensed matter physics (4)	18–22 Aug	6	47	**53**	0.97	7.71	**8.68**
Adriatico Research Conference on Randomness, stochasticity and noise	22–25 Aug	54	36	**90**	6.31	5.29	**11.60**
Adriatico Research Conference on Information theory in classical and quantum physics	29 Aug–1 Sep	26	18	**44**	7.52	3.28	**10.80**
Diploma Course in condensed matter physics (1)	1 Sep–22 Dec	11	3	**14**	31.26	6.58	**37.84**
Workshop on physics and chemistry of transitional metal oxides (including HTC superconductors) (5)	19 Nov–5 Dec	36	12	**48**	12.07	3.9	**15.97**
TOTAL		**990**	**758**	**1748**	**784.88**	**273.73**	**1058.61**
% vs Grand Total				29.79			22.36

Field and Course Name	Dates	Number of Visits			No. of Person-months		
		Dev.	Adv.	Total	Dev.	Adv.	Total
PHYSICS OF THE HIGH AND INTERMEDIATE ENERGIES							
Research in physics of high and intermediate energies and astrophysics	All year	169	74	**243**	277.92	186.79	**464.71**
Research in plasma physics	All year	14	7	**21**	51.99	17.61	**69.60**
Diploma Course in high energy physics (1)	3 Jan–29 Sep	11	4	**15**	79.96	16.51	**96.47**
Spring school and workshop on string theory, gauge theory and quantum gravity	27 Mar–7 Apr	61	108	**169**	28.84	40.78	**69.62**
Conference on recent developments in statistical mechanics and quantum field theory	10–12 Apr	28	75	**103**	5.71	13.86	**19.57**
Conference on perspectives in nuclear physics at intermediate energies	8–12 May	16	80	**96**	4.04	16.01	**20.05**
Trieste conference on S-duality and mirror symmetry	5–9 Jun	31	82	**113**	6.27	16.12	**22.39**
Summer school on high energy physics and cosmology	12 Jun–28 Jul	146	77	**223**	144.98	49.63	**194.61**
Fourth school on non-accelerator particle astrophysics	17–28 Jul	46	53	**99**	19.54	15.67	**35.21**
Diploma Course in high energy physics (1)	1 Sep–22 Dec	11	5	**16**	34.22	13.40	**47.62**
Autumn college on plasma physics	18 Sep–13 Oct	80	17	**97**	73.16	8.21	**81.37**
International topical workshop on plasma physics: Coherent processes in non-linear media	16–20 Oct	37	40	**77**	8.34	7.85	**16.19**
Adriatico Research Conference on Trends in collider spin physics	5–8 Dec	13	46	**59**	3.33	7.15	**10.48**
TOTAL		**663**	**668**	**1331**	**738.3**	**409.59**	**1147.89**
% vs Grand Total				22.69			24.25
MATHEMATICS							
Research in mathematics	All year	107	24	**131**	289.66	46.02	**335.68**
Diploma Course in mathematics (1)	3 Jan–29 Sep	13	6	**19**	89.97	6.52	**96.49**
Conference on topological and geometrical problems related to quantum field theory	13–24 Mar	28	34	**62**	14.19	11.89	**26.08**
Workshop on dynamical systems	22 May–2 Jun	92	66	**158**	43.96	24.77	**68.73**
Conference on partial differential equations and applications to geometry	21 Aug–1 Sep	77	52	**129**	45.08	19.45	**64.53**
Workshop on general theory of partial differential equations and microlocal analysis	4–15 Sep	63	33	**96**	40.82	10.88	**51.70**
Diploma Course in mathematics (1)	1 Sep–22 Dec	11	5	**16**	33.73	11.40	**45.13**
TOTAL		**391**	**220**	**611**	**557.41**	**130.93**	**688.34**
% vs Grand Total				10 41			14 54
PHYSICS AND ENERGY							
Workshop on materials science and physics of non-conventional energy sources	18 Sep–6 Oct	113	26	**139**	68.76	5.60	**74.36**
TOTAL		**113**	**26**	**139**	**68.76**	**5.60**	**74.36**
% vs Grand Total				2.37			1 57

Field and Course Name	Dates	Number of Visits			No. of Person-months		
		Dev.	Adv.	Total	Dev.	Adv.	Total
PHYSICS OF THE ENVIRONMENT							
Aeronomy and Radiopropagation Laboratory	All year	19	10	**29**	41.04	2.32	**43.36**
Structure and non-linear dynamics of the Earth	All year	34	15	**49**	83.63	85.89	**169.52**
Climate and Global Change Group	All year	0	2	**2**	0.00	4.67	**4.67**
International symposium on African drought	31 Jul–4 Aug	52	42	**94**	16.60	15.12	**31.72**
College on soil physics	11–29 Sep	63	10	**73**	40.58	3.90	**44.48**
Workshop on Mediterranean Sea — Circulation, strait exchange and dense water formation processes	23-27 Oct	31	59	**90**	6.81	18.43	**25.24**
Third workshop on non-linear dynamics and earthquake prediction	6–17 Nov	51	16	**67**	26.91	4.93	**31.84**
Workshop on dynamics and statistics of secular climate variations	4–8 Dec	9	21	**30**	2.11	4.09	**6.20**
TOTAL		**259**	**175**	**434**	**217.68**	**139.35**	**357.03**
% vs. Grand Total					7.40		7.54
PHYSICS OF THE LIVING STATE							
First Antonio Borsellino college on neurophysics	15 May–9 Jun	41	35	**76**	35.32	15.02	**50.34**
Symposium on dynamic properties of receptive fields and plasticity of processing systems	17–19 May	35	12	**47**	3.22	1.23	**4.45**
Workshop on quantitative biophysics at the molecular and macromolecular scales	29 Jun–7 Jul	32	18	**50**	9.90	3.33	**13.23**
Adriatico Research Conference on Theoretical models in biological systems	3–7 Jul	38	22	**60**	5.97	2.55	**8.52**
Trieste conference on chemical evolution IV: Physics of the origin and evolution of life	4–8 Sep	22	35	**57**	6.14	7.41	**13.55**
Second school in radiophysics (diagnostic radiology)	23–27 Oct	28	32	**60**	8.65	5.87	**14.52**
TOTAL		**196**	**154**	**350**	**69.20**	**35.41**	**104.61**
% vs Grand Total					5.97		2.21
APPLIED PHYSICS							
Microprocessor Laboratory	All year	7	3	**10**	19.48	6.55	**26.03**
Laboratory for Lasers and Optical Fibres	All year	15	2	**17**	39.66	0.69	**40.35**
High Temperature Superconductivity Laboratory	All year	9	1	**10**	31.45	11.70	**43.15**
Tempus meeting on fibre optics	6–10 Feb	27	5	**32**	11.60	0.36	**11.96**
Conference on ultrafast transmission systems in optical fibres	13–17 Feb	47	37	**84**	11.97	7.20	**19.17**
Second winter college on optics	20 Feb–10 Mar	75	33	**108**	52.81	13.18	**65.99**
African regional college on microprocessor-based real-time control of equipment (6)	25 Sep–13 Oct	44	5	**49**	25.92	2.95	**28.87**
IX International symposium on Ultrafast Processes in Spectroscopy "UPS '95"	30 Oct–3 Nov	57	150	**207**	14.22	27.78	**42.00**
Third school on the use of synchrotron radiation in science and technology	30 Oct–1 Dec	60	30	**90**	63.54	11.74	**75.28**

Field and Course Name	Dates	Number of Visits			No. of Person-months		
		Dev.	Adv.	Total	Dev.	Adv.	Total
Workshop on optical methods for environmental monitoring of the atmosphere	13–17 Nov	48	11	**59**	13.89	1.63	**15.52**
ICTP-UN conference on optical physics in space science and technology	20–24 Nov	32	21	**53**	8.69	3.09	**11.78**
TOTAL		**421**	**298**	**719**	**293.23**	**86.87**	**380.10**
% vs Grand Total				12.25			8.03
MISCELLANEOUS							
Digital communications and computer networking	All year	7	2	**9**	11.19	15.15	**26.34**
Other research	All year	132	33	**165**	176.22	74.36	**250.58**
Science, high technology and development	All year	1	4	**5**	0.10	0.97	**1.07**
Fourth ICTP-URSI-ITU (BDT) college on radiopropagation	30 Jan–3 Mar	41	13	**54**	48.96	9.78	**58.74**
First Bolivian course on computerized data acquisition techniques (7)	13–25 Feb	57	1	**58**	22.24	0.39	**22.63**
Second workshop on rural communications in developing countries	6–10 Mar	44	7	**51**	7.61	1.51	**9.12**
Seminaire sur le système de signalisation CCITT no. 7 à l'intention des pays francophones	20–24 Mar	23	4	**27**	6.70	0.72	**7.42**
Workshop on telematics	2–20 Oct	59	10	**69**	43.64	2.33	**45.97**
TOTAL		**364**	**74**	**438**	**316.66**	**105.21**	**421.87**
% vs Grand Total				7.47			8.91
OUTSIDE ACTIVITIES							
Training and Research in Italian Laboratories	All year	96	1	97	500.48	0.07	500.55
TOTAL		**96**	**1**	**97**	**500.48**	**0.07**	**500.55**
% vs Grand Total				1.65			10.57
TOTAL DEVELOPING		**3493**			**3546.6**		
TOTAL ADVANCED			**2374**			**1186.76**	
GRAND TOTAL				**5867**			**4733.36**

(1) Numbers on Diploma Courses are based on the statistical year (January to December) and not on the academic year (i.e., October 94–September 95, October 95–September 96).
(2) Held in Campinas, Brazil.
(3) Held in Yaoundé, Cameroon.
(4) Held in Gothenburg, Sweden.
(5) Held in Bangalore, India.
(6) Held in Cape Coast, Ghana.
(7) Held in La Paz, Bolivia.

PART II

THE SCIENTIFIC PROGRAMME

PHYSICS OF CONDENSED MATTER

Title: RESEARCH IN PHYSICS OF CONDENSED MATTER

Dates: Throughout the year.

In co-operation with the International School for Advanced Studies (SISSA, Trieste, Italy).

Organizers: Professors S. Lundqvist (Chalmers University of Technology, Göteborg, Sweden, and ICTP), Yu Lu (Academia Sinica, Beijing, P.R. China, and ICTP), E. Tosatti and S. Fantoni (International School for Advanced Studies, SISSA, Trieste, Italy, and ICTP), H. Cerdeira (Universidade Estadual de Campinas, UNICAMP, Campinas, Brazil, and ICTP) and S. Shenoy (University of Hyderabad, India, and ICTP).

Purpose: To carry out research at the highest possible level in condensed matter physics and to stimulate scientific interaction between physicists from the developing world and from advanced countries.

Joint ICTP/SISSA Condensed Matter Seminars

J. KOHANOFF (ICTP) – The high pressure behaviour of metallic hydrogen: The richness of simplicity.

M.Z. CIEPLAK (Warsaw, Poland) – Metal-insulator transition in high-T_c oxides.

J.W.M. FRENKEN (Amsterdam, The Netherlands) – Dynamics and energetics of surfaces measured from STM movies.

P. GADE (ICTP) – Collapse of trajectories in chaotic systems: How true is it?

R. HLUBINA (SISSA) – On the anomalous normal state of the high temperature superconductors.

D. DOMINGUEZ (Los Alamos National Laboratory, USA) – Non-linear dynamics of disordered superconducting networks.

P. CARRA (European Synchrotron Radiation Facility, Grenoble, France) – X-ray dichroism and resonant scattering.

LI Zhibing (Guangzhou/Siegen) – Dynamic Monte Carlo measurement of critical exponents.

J. LAWSON (ICTP) – Functional equations and a new numerical method for quantum field theory.

A.Z. AKHEYAN (Yerevan, Armenia) – Critical properties of the spin-1 Ising model: Doubly reentrant behaviour, staggered phases, multicritical points.

Gh. ADAM (Bucharest, Romania) – Resolving the Fermi surface of 1-2-3 high-T_c superconductors by positron annihilation.

C. CHAKRAVARTY (Delhi, India) – Path integral Monte Carlo simulations of clusters.

S. SENGUPTA (Kalpakkam, India) – Kinematic scaling and crossover to scale invariance in martensite growth.

D. JOUBERT (Johannesburg, South Africa) – Translational and rotational constraints on density-functional derivatives.

J. PENDRY (Imperial College, London, UK) – Heavy light — The electromagnetic properties of complex surfaces.

R. LAIBOWITZ (IBM, Yorktown Heights, USA) – Properties and applications of thin perovskite films including high T_c superconducting cuprates and high dielectric constant titanates.

A. TAGLIACOZZO (Naples, Italy) – Andreev tunneling in Josephson junction chains.
N. KUMAR (Bangalore, India) – Charged particle on a deformable loop with AB-flux: A Jahn-Teller system with arbitrary fractional 'spin'.
N. KUMAR (Bangalore, India) – c-axis resistivity by decoherence of interplanar tunneling: Superconductivity as recovery of the coherence.
S. FRANZ (NORDITA, Copenhagen, Denmark) – Probing the spin glass free energy landscape.
Yu.A. FIRSOV (A.F. Ioffe Physical and Technical Institute, St. Petersburg, Russia) – Order parameter phase fluctuations and topological excitations in quasi-2D superconductors.
S. FRANZ (NORDITA, Copenhagen) – Some aspects of long time relaxation of spin glasses.
M. ROZENBERG (Ecole Normale Supérieure, Paris, France) – The Mott transition in metal-oxides, a large dimensional approach.
G. PEREZ (Mérida, Mexico) – Decoding chaotic messages.
M. MAGNITSKAYA (Troitsk, Russia) – Ab initio electronic-structure calculations of Laves-phase intermetallics.
M. PETTINI (Osservatorio di Arcetri, Italy) – Riemannian description of Hamiltonian chaos.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	28	
Asia	59	1
Europe	24	15
North and Central America	7	11
South America	12	
International Organizations		2
Total	*130*	*29*
Grand Total	***159***	
Countries represented	51	
Int'l Organizations represented	2	
Person-months	276.41	
Applications received	249	

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Title: SEVENTH INTERNATIONAL WORKSHOP ON COMPUTATIONAL CONDENSED MATTER PHYSICS: TOTAL ENERGY AND FORCE METHODS

Dates: 11 - 15 January.

Co-sponsors: Italian National Research Council (Consiglio nazionale delle ricerche, CNR) and International School for Advanced Studies (SISSA, Trieste, Italy).

Organizing Committee: Professors O.K. Andersen (Max-Planck-Institut, Stuttgart, Germany), R.M. Martin (University of Illinois at Urbana-Champaign, USA) and R. Resta (SISSA).

Purpose: To follow-up to the series of workshops started in Oxford (1983) and continued in Braunschweig (1984) and Trieste (1987, 1989, 1991 and 1993).

Programme:
Monte Carlo and Other Many-Electron Methods

R J NEEDS (TCM, Cavendish Laboratory, Cambridge, UK) – Quantum Monte Carlo calculations with special k-points

J GROSSMAN (Beckman Inst , Univ Illinois, Urbana) – Quantum Monte Carlo for electronic structure of clusters and solids

W van SAARLOOS (Inst Lorentz, Leiden Univ , Leiden) – Fixed node Green's function Monte Carlo method for lattice fermions

A MURAMATSU (Inst of Physics, Univ Augsburg, Augsburg) – Quantum Monte Carlo simulations for high-T_c cuprates

A GEORGES (Theoretical Physics Lab , ENS, Paris) – Dynamical mean field theory of strongly correlated electrons

Beyond Density-Functional Theory

F ARYASETIAWAN (Theoretical Physics, Lund Univ , Lund) – GW method for d- and f-systems

S MASSIDDA (Dept Physics, Univ Cagliari, Cagliari) – Self-energy corrections in transition metal oxides

A I LIECHTENSTEIN (MPI fur Festkorperforschung, Stuttgart) – Density functional theory and strong interactions orbital ordering in Mott-Hubbard insulators

A SVANE (Inst of Physics, Univ Århus, Århus) – Self-interaction corrected electronic structure of cerium

Polarization, Fields and Currents

A DAL CORSO (IRRMA, INR Ecublens, Lausanne) – Density functional theory of the nonlinear optical susceptibility

M TSUKADA (Dept Physics, Univ of Tokyo, Tokyo) – Density Functional Theory in a stationary nonequilibrium state

Density-Functional Molecular Dynamics and Phase Transitions

M PARRINELLO (MPI fur Festkorperforschung, Stuttgart) – Ab-initio molecular dynamics studies of chemical processes in condensed phases

G CHIAROTTI (SISSA, Trieste) – Solid-solid phase transformations a new simulation tool

A ALAVI (MPI fur Festkorperforschung, Stuttgart) – Ab-initio molecular dynamics with hot electrons a study of high pressure high temperature H/He mixtures

O SUGINO (Microelectrons Res Lab , NEC, Tsukuba-Ibaraki) – First principles calculations of the phase diagram of silicon

K RABE (Dept Applied Physics, Yale Univ , New Haven) – Lattice Wannier functions and the ferroelectric transition in $PbTiO_3$

Alloys and Surfaces

A MOOKERJEE (S N Bose Nat Centre for Basic Sciences, Calcutta) – Augmented space recursion and phase stability

O PANKRATOV (Fritz-Haber-Inst der MPG, Berlin-Dahlem) – Autolocalization of excitons at surfaces and light-induced desorption

G WAHNSTROM (Dept Applied Physics, Chalmers Univ , Goteborg) – Quantum Monte Carlo study of H diffusion on Ni(100)

New Materials

O F SANKEY (Dept Physics, Arizona State Univ , Tempe) – Wide bandgap Silicon by bending and stretching bonds in Clathrate structures

E TOSATTI (SISSA, Trieste) – Electron conduction in a lattice of Berry phase molecules

O JEPSEN (MPI fur Festkorperforschung, Stuttgart) – From LDA band structures to few-band

Hamiltonians.
B. JOHANSSON (Physics Dept., Uppsala Univ., Uppsala) – Calculated spin and orbital moments in the 3d metal surfaces and 3d/Cu(001) overlayers (3d=Fe, Co, and Ni).

Synchrotron Radiation
M. ALTARELLI (ESRF, Grenoble) – Physics with third generation synchrotron radiation sources: New challenges for theory and experiment.

Approximate Methods for Large Scale Calculations
K. MADER (CECAM-ENS, Lyon) – Electronic structure calculations of ~1000-atom AlAs/GaAs systems.
M. FINNIS (MPI für Metallforschung, Stuttgart) – Computations of Grain boundary structure and energies in metals.
A. HORSFIELD (Dept. Materials, Oxford University, UK) – A rapidly convergent O(N) implementation of tight-binding.
T. FRAUENHEIM (Dept. Physics, Univ. Chemnitz-Zwickau, Chemnitz) – Density functional based construction of tight-binding potentials for MD simulations of semiconductors: C, Si, SiC, BN.
J.K. NØRSKOV (Technical Univ. Denmark, Lyngby) – New developments in effective medium based methods for total energy calculations.
R. PEREZ (TCM, Cavendish Laboratory, Cambridge, UK) – First principles simulations of Silicon nanoindentation.

Posters; general discussions.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	1	
Asia	3	4
Europe	5	153
North and Central America	2	10
South America	1	
International Organizations		1
Total	*12*	*168*
Grand Total	***180***	
Directors and Lecturers	41	
Participants	139	
Countries represented	24	
Int'l Organizations represented	1	
Person-months	28.09	
Applications received	216	

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Title: THEORETICAL AND EXPERIMENTAL WORKSHOP ON THE PHYSICS OF SEMICONDUCTOR MICROSTRUCTURES and ADRIATICO RESEARCH CONFERENCE ON LOWER DIMENSIONALITY SEMICONDUCTOR SYSTEMS, held in Campinas, Brazil.

Dates: 13 - 24 February and 20 - 24 February.

Co-sponsors: European Commission (Brussels, Belgium), Conselho Nacional de Desenvolvimento (CNPq), Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), IBM do Brasil, and Universidade Estadual de Campinas (UNICAMP).

Directors: Professors C.H. Brito Cruz, F. Cerdeira, E.Z. da Silva and L.E. Oliveira (UNICAMP) and H. Cerdeira (ICTP).

Purposes:

Workshop: To provide an advanced experimental and theoretical setup to learn the physics and characterization of semiconductor microstructures.

Conference: To provide a forum for discussion of the physics and technology of semiconductor microstructures.

Programme:

F. CERDEIRA (UNICAMP) – Phonons: Lattice Vibrations. Dispersion and Optical Properties.

L.E. OLIVEIRA (UNICAMP) – Bands (Tight Binding NFE). Shallow Impurities.

A. ANTONELLI (UNICAMP) – Methods for the Calculations of Band Structures.

L. GUIMARAES (UNICAMP) – Semiclassical Theory of Transport.

L. IORATTI (Univ. Federal de São Carlos, UFSCar) – Optical Properties.

G. KLEIMAN (UNICAMP) – Surface Physics.

I. CHAMBOULEYRON (UNICAMP) – Amorphous Systems.

G. MARQUES (UFSCar) – Electronic and B-Vibrational States in Multilayers and Quantum Dots.

P. SCHULZ (UNICAMP) – Tunnelling in Microstructures.

K. ENSSLIN (Universität München) – Transport in Lateral Superlattices: Ballistic Electrons on Chaotic Trajectories.

F. BELTRAM (Scuola Normale Superiore, Pisa) – Heterostructure Devices: Physics and Selected Applications (2 lectures).

T. KAXIRAS (Harvard University) – Dynamics of atoms on semiconductor surfaces: diffusion and growth.

A. PINCZUK (AT&T, Murray Hill) – Inelastic Light Scattering by Electrons in Semiconductor Quantum Wells.

F. BELTRAM (Scuola Normale Superiore, Pisa) – Hot Carriers in Multiquantum Wells: Microwave Detection and Non-Linear Transport.

F. MESEGUER (Universidad Autónoma de Madrid) – Electronic Properties of Semiconductor Quantum Wells Grown on Vicinal Surfaces.

C. PROETTO (Centro Atómico Bariloche) – Elementary Excitation Spectra of Realistic Quantum Wires.

M. SCHEFFLER (Fritz Haber Institut der Max-Planck-Gesellschaft, Berlin) – Theory of Absorption and Desorption of Hydrogen at Si(001).

R. CAR (Institut Romand de Recherche Numérique en Physique des Matériaux, IRRMA PHB, Lausanne) – First-Principle Simulations of First Order Phase Transition in Carbon.

G. ABSTREITER (Schottky Institute, München) – Spectroscopy of Low Dimensional Semiconductor Structures with High Spatial Resolution.

K. ENSSLIN (Universität München) – Antidot Superlattices: Classical Chaos and Quantum Transport.

I. HERNANDEZ CALDERON (Centro de Investigación y de Estudios Avanzados, CINVESTAV) – MBE

Growth and Characterization of II-VI Quantum Well Structures.
J. FERRON (Instituto de Desarrollo Técnico para la Industria, INTEC, Santa Fe) – Chemical Information from Auger Electron Spectroscopy. Application to Reactive Interfaces and Surface Oxidation.
S. CAMARGO (Univ. Federal do Rio de Janeiro) – Silicon Incorporated Hard Hydrogenated Amorphous Carbon Films.
F. ALVAREZ (UNICAMP) – Spectroscopy of Localized States in Amorphous Semiconductors.
R. CAR (IRRMA PHB, Lausanne) – Ab-Initio Studies of Metal Deposition at Semiconductor Surfaces.
R. MERLIN (University of Michigan, Ann Arbor) – Electric-Field Effects in Quantum-Well Structures.
F. CLARO (Pontificia Univ. Católica, Santiago) – Transport in Resonant Multiple Barrier Systems in a Longitudinal Electric Field.
E. LINS DE ALBUQUERQUE (Univ. Federal do Rio Grande do Norte, UFRGN) – Natal Electrodynamics of Polaritons in Superlattices.
A. EFROS (University of Utah, Salt Lake City) – Electron-Electron Interaction in Classical and Near Classical Systems.
E. KAXIRAS (Harvard University) – Dislocations in Silicon: An Application of the Generalized Stacking Fault Concept.
E. ANDA (Univ. Federal Fluminense, Niteroi) – Many body Effects in Mesoscopic Transport.
S. YARTSEV (Inst. Venezolano de Investigaciones Científicas, IVIC, Caracas) – Optical Properties of Low-Dimensional Molecular Crystals.
O. TESCHKE (UNICAMP, Campinas) – Porous Silicon.
C.H. BRITO CRUZ (UNICAMP) – Ultrafast Processes in CdTe Quantum Dots.
A. ZUNGER (National Renewable Energy Laboratory, Goldem) – Pseudopotential Electronic Structure of Si Quantum Films, Wires and Dots.

Tutorials, Laboratory sessions, Discussions, and Contributions.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	3	
Asia	4	
Europe	4	14
North and Central America	4	1
South America	72	
Total	*87*	*15*
Grand Total	***102***	
Directors and Lecturers	5	
Participants	97	
Countries represented	23	
Person-months	36.7	
Applications received	146	

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Title: THIRD ESF WORKSHOP NETWORK ON QUANTUM FLUIDS AND SOLIDS "EXCITATIONS AND SPIN-POLARISED SYSTEMS"

Dates: 20 - 26 April

Co-sponsor: European Science Foundation (ESF)

Directors: Professors S Fantoni (SISSA and ICTP) and A Wyatt (University of Exeter, UK)

Purpose: To address outstanding problems in the areas and consider suggestions for future work

Topics:
Excitation in bulk ^{4}He
Excitations in normal ^{3}He and mixtures
Excitations in superfluid ^{3}He
Vortices and textures in superfluid ^{3}He
Creation and static properties of spin polarised ^{3}He and mixtures
Spin polarised transport in ^{3}He and mixtures
Atomic H and H_2

Programme:

Superfluid ^{3}He

G R PICKETT (Lancaster University, UK) – Excitations in bulk superfluid ^{3}He

M KRUSIUS (Helsinki Univ of Tech , Espoo, Finland) – Quantized vorticity in superfluid ^{3}He-A

H HALL (University of Manchester, UK) – Vortex mutual friction in rotating superfluid ^{3}He

E V THUNEBERG (Helsinki Univ of Tech , Espoo, Finland) – Superfluid ^{3}He in aerogel a homogeneous scattering model

I A FOMIN (P L Kapitza Institute, Moscow, Russia) – Spin currents and precessing domains in normal and superfluid Fermi-liquids

V V DMITRIEV (P L Kapitza Institute, Moscow, Russia) – Experiments on coherently precessing spin state in normal ^{3}He

Yu M BUNKOV (CRTBT-CNRS, Grenoble, France) – The relative precession of the magnetization of superfluid and normal components of a Fermi liquid, magnetic analog of second sound

R HARAKALY (P J Safarik University, Kosice, Slovakia) – Nonwetting regime in homogeneously precessing domain

Poster session

Superfluid ^{4}He

V S YARUNIN (Joint Inst for Nucl Res , Dubna, Russia) – Structure of liquid ^{4}He excitations spectrum

F DALFOVO (Universita di Trento, Povo, Italy) – Bounds for the phonon-roton dispersion in superfluid ^{4}He

F PEDERIVA (Universita di Trento, Povo, Italy) – ^{3}He Impurities in solid ^{4}He

M BONINSEGNI (Univ of Illinois, Urbana, USA) – Calculation of the dynamic form factor for liquid helium

H LAMBARE (Ecole Normale Superieure, Paris, France) – Quantum cavitation in superfluid helium 4 ?

S STRINGARI (Universita di Trento, Povo, Italy) – Theory of quantum evaporation

A C FORBES (CRTBT-CNRS, Grenoble, France) – High-energy phonon creation by phonon-phonon scattering in superfluid ^{4}He

A F G WYATT (University of Exeter, UK) – The scattering of rotons by thermal phonons in ^{4}He

P ROCHE (CE Saclay, Gif-sur-Yvette, France) – Ripplon damping

V B ELTSOV (P L Kapitza Institute, Moscow, Russia) – Optical spectra of triplet excimer

molecules $^4He_2$ in superfluid helium in polarizing magnetic field.
Poster session and discussion on droplets.

Hydrogen

D.M. CEPERLEY (Beckman Institute, Illinois, USA) – PIMC calculations of superfluidity of molecular hydrogen.

T.W. HIJMANS (Univ. Amsterdam, The Netherlands) – Spin-polarized atomic hydrogen.

F. POBELL (University of Bayreuth, Germany) – Supercooled hydrogen in an oscillating porous vycor glass.

S.A. VASILYEV (Kurchatov Institute, Moscow, Russia) – Magnetic compression of spin-polarized atomic hydrogen adsorbed on liquid helium-4.

G. FROSSATI (Leiden University, The Netherlands) – Gravitational detectors.

Visit to Sincrotrone (Trieste).

^4He-^3He mixtures

R. JOCHEMSEN (Leiden University, The Netherlands) – Creation and static properties of spin-polarised ^3He and mixtures.

P.J. NACHER (Lab. Kastler Brossel, Paris, France) – Steady-state production of large magnetizations in liquid ^3He-^4He mixtures.

G. VERMEULEN (CNRS, Grenoble, France) – Degenerate spin-polarized liquid ^3He in a ^4He circulating dilution refrigerator.

A.E. MEYEROVICH (Univ. Rhode Island, Kingston, USA) – Transport and spin dynamics in spin-polarized ^3He and ^3He-^4He mixtures.

J.R. OWERS-BRADLEY (University of Nottingham, UK) – Longitudinal and transverse spin diffusion in ^3He-^4He solutions in a strong magnetic field.

J.H. AGER (University of Nottingham, UK) – Spin-wave instabilities in spin-polarized ^3He-^4He solutions.

E. STOLTZ (Lab. Kastler Brossel, Paris, France) – NMR in highly-magnetized samples: Magnetostatic modes induced by dipolar fields.

C.M.C.M. van WOERKENS (Leiden Univ., The Netherlands) – Spin-polarized concentrated ^3He-^4He mixtures: New techniques to employ the rapid melting method.

A. FABROCINI (Department of Physics, Pisa, Italy) – A microscopic calculation of the response in liquid ^3He-^4He mixtures.

Mixtures and spin polarised ^3He

B. FAK (CEA, DRFMC/SPSMS/MDN, Grenoble, France) – Excitations in normal ^3He and ^3He-^4He mixtures.

D. GALLI (Università degli Studi di Milano, Italy) – Improved description of maxon-roton excitations in superfluid ^4He with shadow wave function.

R. SCHRENK (Univ. Bayreuth, Germany) – Nuclear magnetic ordering of solid and suppression of the superfluid state of liquid ^3He-droplets in solid ^4He.

M. WEYRAUCH (Phys. Techn. Bundesanstalt, Germany) – Density-density correlations in ^3He-^4He mixtures.

D.A. TAYURSKII (Kazan State University, Russia) – The magnetic relaxation of liquid helium-3 on the paramagnetic crystal surface.

S. MORONI (Scuola Normale Superiore, Pisa, Italy) – Normal and fully polarized ^3He: a diffusion Monte Carlo calculation.

V.B. SHIKIN (Russian Acad. Sci., Chernogolovka, Russia) – Helium ions in solution ^3He-^4He.

E.P. BASHKIN (Philipps-Univ., Marburg, Germany) – Quadrupole magnetic excitations in spin-polarized quantum fluids.

B. COWAN (Royal Holloway Univ. of London, Surrey, U.K.) – Leggett-Rice effect in polarised solid ^{3}He.

A. VONCKEN (Univ. Bayreuth, Germany) – Thermal boundary resistance between an Ag sinter and a saturated ^{3}He-^{4}He mixture as well as superfluid ^{3}He-B in the sub-millikelvin regime.

Poster session.

M.H. KALOS (Cornell University, Ithaca, NY, USA) – Correlated walkers in many-fermion Monte Carlo.

L. REATTO (Università di Milano, Italy) – Summary Talk.

H. HALL (University of Manchester, UK) – Summary Talk.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Asia	1	
Europe	14	52
North and Central America		5
International Organizations		1
Total	*15*	*58*
Grand Total	***73***	
Directors and Lecturers	20	
Participants	53	
Countries represented	14	
Int'l Organizations represented	1	
Person-months	19.07	
Applications received	94	

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Title: COLLEGE ON COMPUTATIONAL PHYSICS

Dates: 15 May – 9 June.

Directors: Professors S. Baroni (International School for Advanced Studies, SISSA, Trieste, Italy), V. Kumar (Indira Gandhi Centre for Atomic Research, Kalpakkam, India), A. Nobile (local organizer, ICTP), and C. Rebbi (Boston University, USA).

Purpose: To provide training in the methods of computational physics, with particular emphasis on the techniques used for the study of microscopic phenomena, such as encountered in condensed matter or particle physics.

Report: This was the fifth of a series of Colleges on Computational Physics held at the International Centre for Theoretical Physics since 1986. The College attracted a very good response which made it possible to select participants with excellent background.

This edition of the College was planned with a focus on Computational Materials Science and Statistical Mechanics. It covered several important topics ranging from general computational techniques to classical and ab initio molecular dynamics, classical and quantum Monte Carlo simulations, electronic structure calculations, wavelets and their applications. There were also lectures on new developments such as Fortran 90, High Performance Fortran, parallel computing

and applications, and the World Wide Web. Mornings were completely devoted to lectures. One further lecture and/or specialized seminar was generally presented in the afternoon and the remaining time was used for computer exercises. The participants were divided into four major groups, namely Monte Carlo simulations, molecular dynamics, electronic structure methods and partial differential equations, according to their main points of interest. The good level of participants was reflected also in the number and quality of the seminars which many of them gave within the groups.

A questionnaire was distributed among the participants. From the answers as well as from informal discussions with the participants and lecturers, it emerged that the College was a success. The lecturers were leading experts in their fields and interacted with the participants. Some of them installed software on the ICTP machines and demonstrations were arranged. The expertise and dedication of the tutors, together with the number of personal computers available to the participants, larger than ever before, made the tutorial sessions by far the best in all editions of this College. There were 30 personal computers running Unix (in addition to DOS/Windows) specifically dedicated to the participants of the College, which were heavily utilized even late in the evening and on weekends. As the number of participants in each tutorial session was more than 30, the availability of a few more personal computers would have been desirable. A special session was arranged at 22:00 hours for World Wide Web access on the network (during daytime, unfortunately, the high traffic congestion along international routes makes the use of the Web impractical, especially for tutorial demonstrations). The participants could carry home the software demonstrated in the College. Some of the software was written especially for the College in Fortran 90 language. This will help the participants to pick up Fortran 90 which is expected to replace Fortran 77 in the near future.

For a few participants some lectures were too advanced while a few would have liked more lectures on specialized topics. This is inevitable when there are participants with varied interests. But as a whole it was a balanced College, though there is always room for improvements. Our earlier suggestion that the College should be followed by a specialized workshop was taken up this year and a Workshop on Electronic Structure Methods in Materials Science and Engineering took place immediately after the College. Some of the participants at the College stayed for this Workshop, thus leveraging the benefit they received from both. We recommend that this practice be continued in the future.

In developed countries there is an ever increasing application of computers to the development of the methodologies/models/materials needed to find solutions to the most challenging scientific, technological and economic problems. Since computers are progressively becoming more easily accessible and affordable in many developing countries, we feel that it would not only be useful to continue to organize Colleges on Computational Physics, but to hold them every year, so that in alternate years there can be a College on Computational Materials Science and some College dealing with other topics and techniques (e.g. fluid dynamics applications). It is not difficult to find talented people in developing countries. What is lacking are the facilities and a conducive environment for research. Experimental research is very expensive and only limited progress can be hoped for the near future in developing countries. On the other hand, computers can be very effectively used by researchers working in very diverse areas, because large amounts of software are today available in the public domain and there are possibilities for using computers through the Internet if one own's facilities are not powerful enough. ICTP has been and can play an extremely important role in this development. From informal discussions with participants from Africa and Latin America, one of us (Vijay Kumar) noted that many countries now have access to Internet (even in some African countries) although their respective computational facilities are inadequate for any serious computational effort. Moreover, one expects that Internet access will become available to several other countries in the near future, while it will probably take some amount of time before good computational facilities become available there. We recommend, therefore, that a special effort be made to enhance substantially the computational facilities at the ICTP, thus making the Centre a provider of remote resources for those scientists from developing countries who have access to the Internet but not yet to

adequate computers in their own home countries. When there is a large number of visitors at the ICTP, as happens regularly during the summers, it becomes difficult to get time on IBM machine, and the turnout becomes very slow. Visitors to ICTP would derive enormous benefit from an improvement of the computational facilities, which, during the leaner periods, could be made available to researchers in developing countries through the Internet.

S. Baroni, V. Kumar,
C. Rebbi, A. Nobile

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	13	
Asia	35	
Europe	17	8
North and Central America	3	5
South America	9	
International Organizations		3
Total	*77*	*16*
Grand Total	***93***	
Directors and Lecturers	11	
Participants	82	
Countries represented	35	
Int'l Organizations represented	2	
Person-months	80.21	

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Title: WORKSHOP ON COMPUTATIONAL METHODS IN MATERIAL SCIENCE AND ENGINEERING

Dates: 12 - 23 June.

Co-sponsors: European Commission (Brussels, Belgium).

Directors: Professors P. Ballone (Max-Planck-Institut, Stuttgart, Germany), S. Baroni (SISSA) and M. Klein (University of Pennsylvania, Philadelphia, USA).

Purpose: To provide a self-contained overview of the available theoretical and computational tools for predicting the physical properties of specific systems (as opposed to simplified models) of interest in materials science.

Programme:

P. BALLONE (Max-Planck-Institut, Stuttgart, Germany) – Overview of computational methods in materials science (2 lectures).

R. JONES (KFA Forschungszentrum Jülich, Germany) – Density-functional theory of atoms, molecules and solids (3 lectures).

M. SPRIK (I.B.M., Zürich, Switzerland) – Molecular dynamics simulations in statistical mechanics and materials science (3 lectures).

V. FIORENTINI (Univ. degli Studi di Cagliari, Italy) – Pseudopotential techniques in electronic structure applications (2 lectures).

S. BARONI (SISSA, Trieste, Italy) – Density functional perturbation theory: ab-initio calculation

of lattice vibrations (2 lectures).
I. SIEPMANN (University of Minnesota, USA) – Monte Carlo simulations in materials science (3 lectures).
S. BARONI (SISSA, Trieste, Italy) – Density functional perturbation theory: semiconductor alloys from computational alchemy.
F. WILLAIME (CEA, Gif-sur-Yvette, France) – Tight binding methods (2 lectures).
M. BERNASCONI (Max-Planck-Inst., Stuttgart, Germany) – Ab-initio simulations in the NPH ensemble.
M. METHFESSEL (Instit. für Halbleiterphysik, Frankfurt, Germany) – LMTO methods for electronic structure calculations (2 lectures).
A. BALDERESCHI (Università di Trieste, Italy) – Semiconductor interfaces.
M. PARRINELLO (Max-Planck-Institut, Stuttgart, Germany) – Ab-initio molecular dynamics (2 lectures).
K. STOKBRO (SISSA, Trieste, Italy) – Semiempirical models and simplified ab-initio approaches (2 lectures).
A. CARO (Centro Atómico Bariloche, Argentina) – Tight-binding and embedded-atom molecular dynamics (2 lectures).
P. BALLONE (Max-Planck-Institut, Stuttgart, Germany) – Embedded-atom potentials (2 lectures).
M. ROBBINS (Johns Hopkins University, Baltimore, USA) – Molecular-dynamics simulations of friction, lubrication and other complex surface-related phenomena (2 lectures).
V. VITEK (University of Pennsylvania, USA) – Molecular dynamics simulation of phenomena of metallurgical interest (2 lectures).
F. ERCOLESSI (SISSA, Trieste, Italy) – Glue-model potentials: from force-matching fits to large-scale applications.
U. LANDMANN (Georgia Institute of Tech., USA) – Computer simulation in nanotribology.
M. KLEIN (University of Pennsylvania, USA) – Studies of microscopic wetting phenomena.
M. KLEIN (University of Pennsylvania, USA) – Expanded-metal compounds, conducting fluids and the metal-insulator transition.
S. YASHONATH (Indian Institute of Science, Bangalore, India) – MD simulation of molecules in Zeolites (2 lectures).
U. ROETHLISBERGER (Max-Planck-Institut, Stuttgart, Germany) – Ab-initio simulation of organic molecules.
P. CARLONI (Università di Firenze, Italy) – Computer modeling of bio-molecules (2 lectures).

Plenary Seminars, in conjuction with the Research Workshop on Condensed Matter Physics (12 June - 18 August):
M.V. RAMAKRISHNA (New York University, USA) – Chemical reactions of silicon clusters.
B.N.J. PERSSON (KFA, Jülich, Germany) – Sliding friction: where is the physics?

Computer tutorials, Poster sessions.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	6	
Asia	23	
Europe	11	24
North and Central America	1	6
South America	9	
Total	*50*	*30*
Grand Total	***80***	
Directors and Lecturers	21	
Participants	59	
Countries represented	32	
Person-months	28.61	
Applications received	229	

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Title: RESEARCH WORKSHOP ON CONDENSED MATTER PHYSICS

Dates: 12 June - 18 August.

Co-sponsors: European Commission (Brussels, Belgium), and Italian National Institute for the Physics of Matter (INFM).

Directors: Professors G. Baskaran (Institute of Mathematical Sciences, Madras, India), F. Bassani (Scuola Normale Superiore, Pisa, Italy), E. Burstein (University of Pennsylvania, Philadelphia, PA, USA), P.N. Butcher (University of Warwick, Coventry, UK), H. Cerdeira (Universidade Estadual de Campinas, UNICAMP, Campinas, Brazil, and ICTP), S. Fantoni (International School for Advanced Studies, SISSA, Trieste, Italy, and ICTP), F. Garcia-Moliner (Instituto de Ciencias de Materiales, Madrid, Spain), F. Gautier (Université Louis Pasteur, Strasbourg, France), S. Lundqvist (Chalmers University of Technology, Gothenburg, Sweden, and ICTP), Chi Wei Lung (International Centre for Materials Physics, Academia Sinica, Shenyang, China), N.H. March (University of Oxford, UK), A. Mookerjee (S.N. Bose National Centre for Basic Sciences, Calcutta, India), F.S. Persico (Università di Palermo, Italy), T.V. Ramakrishnan (Indian Institute of Science, Bangalore, India), S.R. Shenoy (University of Hyderabad, India, and ICTP), E. Tosatti (International School for Advanced Studies, SISSA, Trieste, Italy, and ICTP), M.P. Tosi (Scuola Normale Superiore, Pisa, Italy) and Yu Lu (Institute of Theoretical Physics, Academia Sinica, Beijing, P.R. China, and ICTP).

Purpose: To support research on condensed matter physics and related areas in developing countries and to promote strong interactions between physicists from all over the world.

Report: This has been the 26th of the series of Condensed Matter Summer Workshops organized at ICTP and has been the fourth year that the Workshop combines some focused activities with researches along certain lines.

Four major activities, namely, the Workshop on "Computational Methods in Materials, Science and Engineering" (12-23 June), the Workshop on Quantitative Biophysics at the Molecular and Macromolecular Scales (29 June - 7 July), the Miniworkshop on Quantum Incoherence in Strongly Correlated Systems (3-21 July) and the Miniworkshop on Josephson Junction Arrays (7-11 August) have been the "highlights" of this Condensed Matter Workshop and have been very successful. Moreover, the other two focused activities, the Working Group on "Surface and Bulk Magnetism" (26 June - 7 July) and the Working Party on the Fabrication, Physics and Applications of Quantum Dots (31 July - 4 August) have also attracted a large

number of outstanding lecturers as well as active participants. In addition, the group activities along the research lines "Classical and Quantum Liquids" and "Semiconductor Physics" have been also well-organized and successful.

In general, this re-organization of the Workshop helps to expose Condensed Matter physicists to the latest developments in the field. The overall response has been positive. At the same time, more pedagogical lectures are needed in the future to prepare less experienced researchers for entering new areas.

Yu Lu

Programme:

Plenary Seminars:

M.V. RAMAKRISHNA (New York Univ., USA) – Chemical reactions of silicon clusters.

B.N.J. PERSSON (KFA Jülich, Germany) – Sliding friction: where is the physics?

V. KUMAR (Indira Gandhi Centre, Kalpakkam, India) – Clusters and cluster assembled materials.

H. FRAUENFELDER (Santa Fe Institute and Los Alamos Nat. Lab., USA) – Proteins as complex structures.

P. LEE (Massachusetts Inst. of Technology, Physics Dept., Cambridge, MA, USA) – Is the half filled Landau level a non-Fermi liquid metal?

B. HU (Univ. Houston, Houston, TX, & Hong Kong Baptist Univ., Kowloon, Hong Kong) – Universality in the Frenkel-Kontorova model.

J. JAIN (State Univ. of New York, Stony Brook, NY, USA) – Composite fermion: A new particle in condensed matter physics.

A. HOLAS (Inst. Physical Chemistry, Polish Academy of Sciences, Warsaw, Poland) and N. MARCH (Univ. of Oxford, Theoretical Chemistry Dept., Oxford, UK) – Density functional theory via density matrices: the exact exchange - correlation potential.

G. LONZARICH (Univ. of Cambridge, UK) – Quantum critical behaviour, strong correlation and two dimensional metals.

H. ORLAND (CEN Saclay, Serv. de Physique Théorique, Gif-sur-Yvette, France) – Analytical models for protein folding.

I. AFFLECK (Univ. of British Columbia, Vancouver, Canada) – Exotic Quantum Effects in One-Dimensional Quantum Antiferromagnets.

I. DZYALOSHINSKI (Univ. of California, Irvine, CA, USA) – Condensed Matter Physics and its Relation to Particle Physics.

L. REATTO (Univ. of Milan, Italy) – Theory of phase transitions and critical phenomena in classical fluids.

C. MARCUS (Stanford Univ., Dept. of Physics, Stanford, USA) – Mesoscopic fluctuations and quantum chaos.

O. HEINONEN (Univ. of Central Florida Dept. of Physics, Orlando, FL, USA) – New developments in finite fractional quantum Hall systems.

R. ASHOORI (MIT, Dept. of Physics, Cambridge, MA, USA) – Many body physics of few electron quantum dots.

A. MAJHOFER (Warsaw Univ., Poland) – Flux pinning, inductance effects and critical state behaviour in JJA.

B. HOROVITZ (Ben-Gurion Univ., Beer-Sheva, Israel) – Quantum Hall effect in a vortex liquid.

A. PINCZUK (AT&T Bell Laboratories, Murray Hill, NJ, USA) – Inelastic light scattering in the Quantum Hall regimes.

Group Activities:

Electronic structure

B. GUMHALTER (Inst. of Physics, Univ. of Zagreb, Croatia) – Excitation of electron-hole pairs in atom-surface scattering.

G. LITAK (Lublin Tech. Univ., Dept. of Mechanics, Lublin, Poland) – A recursion method for Bogoliubov equations.
N. ZEKRI (Univ. d'Oran, Dept. of Physics, Oran, Algeria) – Nature of the electronic states in 1-d disordered chains in an electric field.
D. CHATURVEDI (Kurukshetra Univ., Physics Dept., Kurukshetra, India) – Matter transport in alloy through dumbell defects.

Classical quantum liquids
A. BJELIS (Univ. of Zagreb, Croatia) – Dielectric properties of multi-band electron systems.
D.I. PUSHKAROV (Inst. Solid State Physics, Bulgarian Acad. of Sciences, Sofia, Bulgaria) – Quasiparticle transport in deformable solids.
A. HOLAS (Inst. Phys. Chem. PAS, Warsaw, Poland) – Coordinate space form of interacting reference response function of jellium model.
O. DERZHKO (Inst. Condensed Matter Phys., Lvov, Ukraine) – Equilibrium properties of fluids with resonance dipole-dipole interactions.
M. HOLOVKO (Inst. for Condensed Matter, Lvov, Ukraine) – The association phenomena in liquids and solutions. The statistical mechanical approach.
S. CONTI (Scuola Normale Superiore, Pisa) – Dielectric screening and momentum distribution of the degenerate plasma of charged bosons.
L. REATTO (Univ. of Milan, Italy) – Progress in variational theory of liquid and solid ^{4}He.
C. MALYSHEV (V.A. Steklov Mathematical Institute, St. Petersburg, Russia) – Mass current in ^{3}He-A: some exact representations and their London limit.
V. TOZZINI (Scuola Normale Superiore, Pisa, Italy) – ^{4}He: links between the elementary excitation spectrum of liquid and crystal near the phase transition.
M.L. CHIOFALO (Scuola Normale Superiore, Pisa, Italy) – Some superconducting and normal state properties in the large polaron bipolaron model.
N. NAFARI (Centre for Theoretical Physics & Mathematics, AEO of Iran, Tehran, Iran) – Microscopic theory of normal liquid ^{3}He.
D.K. CHATURVEDI (Kurukshetra Univ., India) – Dynamics of 2D liquid on periodic substrate: Rb in graphite.

Semiconductor Physics
R. PRASAD (IIT, Kanpur, India) – Staebler-Wronski effect in amorphous hydrogenated silicon.
C. PROETTO (Centro Atómico Bariloche, San Carlos de Bariloche, Argentina) – Magnetoplasmons in confined geometries.
BANG-FEN ZHU (Inst. Semiconductors, Beijing, China) – Enhanced Quantum Well Pockles effect.
NGUYEN QUANG BAU (Hanoi State Univ., Dept. Theoretical Physics, Hanoi, Vietnam) – The Quantum theory of absorption of EM waves by free electrons in superlattices.
V. RYZHII (University of Aizu, Aizu-Wakamatsu, Japan) – Device Physics of Quantum-well infrared phototransistors.
A.K. HARIRI (Univ. Aleppo, Dept. of Physics, Aleppo, Syrian Arab Republic) – The effect of source material on CdS thin film.
NGUYEN HONG QUANG (Inst. Theoretical Physics, Hanoi, Vietnam) – Phonoritons in highly excited semiconductors.
A. ALDEA (I.F.T.M., Institute of Atomic Physics, Bucharest, Romania) – Tunnelling in Quantum wells.
XIE JIANJUN (Fudan Univ., Dept. Physics, Shanghai, P.R. China) – Electronic structure of GaN and $Si_{1-x-y}C_xGe_y$ alloys.
Y. GUREVICH (Centro de Investigación y de Estudios Avanzados del I.P.N., Mexico City, Mexico) – Thermoelectric phenomena in bipolar semiconductors.

D.M.K. QUAZI (Univ. of Eng. & Tech., Dhaka, Bangladesh) – Hole trapping phenomena in the oxide of an MOS structure.
V.A. KOCHELAP and B.A. GLAVIN (Inst. of Semiconductor Physics, Kiev, Ukraine) – Patterns in bistable resonant tunneling systems.
B.B. KARKI (Univ. of Edinburgh, Scotland) – The ab-initio lattice dynamics of $AgGaSe_2$ Chalcopyrite.
O.E. RAICHEV (Inst. of Semiconductors, Kiev, Ukraine) – Transport in coupled quantum wells: resistance resonance and related phenomena.
A. CABO MONTES DA OCA (Instituto de Matemática, Cibernética y Física, Habana, Cuba) – On minimal energy Hartee-Fock states for a 2DE9 at fractional fillings.
C.G. MENDEZ (Centro Atómico Bariloche, S. Carlos de Bariloche, Argentina) – Edge channels in fractional-quantum Hall-effect.

Correlated Electron Systems
I. DZYALOSHINSKI (Univ. of California, Irvine, CA, USA) – Extended van Hove singularity and related non-Fermi liquids - Part II.
NGUYEN VAN HIEU (Institute of Physics, N.C.S.T., Hanoi, Vietnam) – Strong correlation of electrons in t-J model of high-T_c superconductivity.
SUN XIN (Fudan University, Shanghai, P.R. of China) – The effect of electron correlation in coherence length of conjugated polymer.

Superconductivity Phenomenology
S.K. GHOSHAL (Jawaharlal Nehru Univ., New Delhi, India) – Kinetics of defect-mediated structural phase transition in YBCO.
T. KRZYSZTON (Inst. of Low Temperature & Structure Research, Wroclaw, Poland) – Possibility of anomalous flux penetration in antiferromagnetic superconductors.
M.R. KOLAHCHI (Amir Kabir Univ., Tehran, Iran) – Josephson Junction Arrays in magnetic field.

Working Group on "Surface and bulk magnetism" (26 June - 7 July), directed by Professor A. Mokerjee (S.N. Bose National Centre for Basic Sciences, Calcutta, India):
R. PRASAD (IIT, Kanpur, India) – KKR approach to disordered alloys (2 lectures).
S. BLÜGEL (IFF Forschungszentrum Jülich, Germany) – Introduction to magnetism in reduced dimensions.
L. SZUNYOGH (Inst. of Physics, Technical University of Budapest, Hungary) – Theory of the screened Korringa-Kohn-Rostoker method with application to surfaces and interfaces.
S. BLÜGEL (IFF Forschungszentrum Jülich, Germany) – Magnetism of ultrathin films (2 lectures).
L. SZUNYOGH (Inst. of Physics, Technical University of Budapest, Hungary) – Relativistic spin-polarized calculations for ferromagnetic layers systems: (a) Perpendicular magnetic anisotropy in Fe multilayers on Au(001); (b) Magnetism of 4d-Sd transition metal adlayers on Ag(001) and Au(001).
A. FORTUNELLI (Ist. di Chimica Quantistica, CNR-ICQEM, Pisa, Italy) – Ab initio derivation of an extended Hubbard Hamiltonian from the relaxed orbital model.
A. MOOKERJEE (S.N. Bose Nat. Centre, Calcutta, India) – Dynamical CPA and the Hubbard model (2 lectures).
A. FORTUNELLI (Ist. di Chimica Quantistica, CNR-ICQEM, Pisa, Italy) – Some traceable limits of the extended Hubbard Hamiltonian and relationship with other model Hamiltonians.
S. BLÜGEL (IFF Forschungszentrum Jülich, Germany) – Impact of magnetism for structure and stability of films.
S. BLÜGEL (IFF Forschungszentrum Jülich, Germany) – Hyperfine fields at internal interfaces.
P. BRUNO (Institut d'Electronique Fondamentale, Univ. Paris Sud, Orsay, France) – Interlayer

exchange coupling (2 lectures).
A.B. SHICK (Acad. Science, Prague, Czech Republic) – Fully relativistic spin-polarized TB LMTO-CPA for electronic structure calculations: an introduction.
L.V. DOBYSHEVA (Physics & Tech. Inst., Ural Branch, Izhevsk, Russia) – The formation of the magnetic moments in disordered binary alloys of metal-metalloid type.
J. KÜBLER (Inst. fur Festkörperphysik, Tech. Hochschule Darmstadt, Germany) – The Kohn-Sham equations for non uniformly magnetized systems.
A.B. SHICK (Acad. Science, Prague, Czech Republic) – Relativistic electronic and magnetic structure of Co-based transition metal alloys.
J. KÜBLER (Inst. fur Festkörperphysik, Tech. Hochschule Darmstadt, Germany) – The magnetic susceptibility.
P. BRUNO (Institut d'Electronique Fondamentale, Univ. Paris Sud, Orsay, France) – Magneto-optical Kerr effect in ultrathin films.
T. SAHA (S.N. Bose Nat. Centre, Calcutta, India) – Electronic structure and alloy phase stability.
J. KÜBLER (Inst. fur Festkörperphysik, Tech. Hochschule Darmstadt, Germany) – Noncollinear ground states.
G. PARI (Anna University, Madras, India) – Density functional description of the electronic structure of LAMO-3 (M=Sc-Ni).
J. KÜBLER (Inst. fur Festkörperphysik, Tech. Hochschule Darmstadt, Germany) – Towards the Curie temperature.
S. BASU (IIT, Kanpur, India) – Study of gap states in Mott-Hubbard antiferromagnets doped with static impurities.

Talks by Participants.

Working party on the fabrication, physics and applications of quantum dots (31 July - 4 August):
P. BETON (Nottingham University, Nottingham, UK) – Wires, dots and STM fabrication (2 lectures).
Y. E. LOZOVIK (Inst. of Spectroscopy, Physics & Astrophysics, Moscow Region, Troitsk, Russia) – Quantum dots in magnetic fields.
C.R. PROETTO (Centro Atómico Bariloche, San Carlos de Bariloche, Argentina) – Strong confinement approach for impurities in quantum dots.
L. KOUWENHOVEN (Technische Univ. Delft, Fac. Technische Natuurkunde, Delft, The Netherlands) & C. MARCUS (Stanford Univ., Dept. of Physics, Stanford, USA) – Phase relaxation in O-D quantum dots.
L. KOUWENHOVEN (Technische Univ. Delft, Fac. Technische Natuurkunde, Delft, The Netherlands) – High frequency response of quantum dots.
I. LARKIN (Glasgow Univ., Dept. Electrical Engineering, Glasgow, Scotland) – Spectroscopy of quantum dots in the few electron limit.
D. HEITMANN (Inst. für Angewandte Physics, Univ. Hamburg, Germany) – FIR spectroscopy of semiconductor quantum dots and antidot arrays.
C.J.B. FORD (Cavendish Laboratory, Cambridge, UK) – Edge states and antidots: Coulomb and single-particle effects in the integer and fractional quantum Hall regimes (2 lectures).
P.N. BUTCHER (University of Warwick, UK) – A wave function matching technique for 2D nanostructures.
O. HEINONEN (Univ. of Central Florida, Dept. of Physics, Orlando, FL, USA) – Quantum Hall effect in finite geometries (overview and background).
R. ASHOORI (MIT, Dept. of Physics, Cambridge, MA, USA) – Physics of unintentional quantum dots.

D. HEITMANN (Inst. für Angewandte Physics, Univ. Hamburg, Germany) – Lateral symmetries, internal motions and collective effects in quantum dots.
I. LARKIN (Glasgow Univ., Dept. Electrical Engineering, Glasgow, Scotland) – Edge of the two dimensional electron gas in a gated heterostructure.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	27	
Asia	104	3
Europe	67	71
North and Central America	15	17
South America	21	
International Organizations		5
Total	*234*	*96*
Grand Total	***330***	
Directors and Lecturers	63	
Participants	267	
Countries represented	58	
Int'l Organizations represented	2	
Person-months	264.94	
Applications received	608	

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Title: ADRIATICO RESEARCH CONFERENCE ON PHYSICS OF SLIDING FRICTION

Dates: 20 - 23 June.

Co-sponsors: Italian National Research Council (CNR), European Commission (Brussels, Belgium), Fondazione IBM Italia, NATO (Brussels, Belgium), International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: Professors U. Dürig (IBM Zürich Research Laboratory, Rüschlikon, Switzerland), B.N.J. Persson (Forschungszentrum Jülich GmbH, Jülich, Germany), G. Reiter (Laboratoire Leon Brillouin, Gif-sur-Yvette, France), and E. Tosatti (SISSA and ICTP).

Purpose: To bring together the leading scientists in the various subfields of interfacial sliding for intensive discussions.

Programme:
T. BAUMBERGER (Ecole Normale Supérieure, LPMC, Paris) – Dry Friction Dynamics at Low Sliding Velocities: Creep and Stick-Slip I. Experiments on Model Systems.
C. CAROLI (Université Paris VII) – Dry Friction Dynamics at Low Sliding Velocities: Creep and Stick-Slip II. A Simple Theoretical Approach.
J.N. ISRAELACHVILI (University of California at Santa Barbara) – Experimental Investigation of Stick-Slip Mechanisms.
B.N.J. PERSSON (Institute für Festkörperforschung, Jülich) – Sliding of Adsorbate Layers: Boundary Lubrication.
S. GRANICK (University of Illinois, Urbana) – Noise, Scatter and Fluctuation of Friction.

SEE-CHEN YING (Brown University, Providence) – Sliding Friction in the Frenkel-Kontorowa Model

G REITER (Laboratoire Leon Brillouin, Gif-sur-Yvette) – What Determines Static Friction and Controls the Transition to Sliding

J KRIM (Northeastern University, Boston) – Electronic Contributions to Sliding Friction

D SCHUMACHER (Universität Dusseldorf) – Probing the Electronic Friction via Surface Resistivity Measurements

J B SOKOLOFF (Northeastern University, Boston) – Theory of Electronic and Phononic Contributions to Atomic Scale Friction

C H WOLL (Universitat Heidelberg) – External Vibrations of Molecular Species on Metal Surfaces

A I VOLOKITIN (Samara State Technical University, Russia) – Damping of Vibrations in Adsorbed Molecules

M O ROBBINS (Johns Hopkins University, Baltimore) – Probing the Molecular Origins of Friction with Computer Simulations

W T TYSOE (University of Wisconsin, Milwaukee) – The Surface Chemistry of Chlorinated Hydrocarbon Lubricant Additives Friction, Adheasion, Layering and Surface Melting

J N ISRAELACHVILI (University of California at Santa Barbara) – Adheasion in Relation to Friction

E TOSATTI (ICTP, Trieste) – Surface Melting

S C COLBECK (Cold Regions Research & Engineering Lab , Hannover) – The Physics of Snow Friction

J F NYE (H H Wills Physics Laboratory, Bristol) – The Sliding of Glaciers

U DURIG (IBM Research Division, Ruschlikon) – Adheasion on the Atomic Scale

U LANDMAN (Georgia Institute of Technology, Atlanta) – Nano-Viscoelasticity Dynamics in Lubricated Junctions

E MEYER (University of Basel) – Friction Force Microscope Applications and Contract Mechanisms

U D SCHWARZ (Universitat Hamburg) – Low-Load Friction Behaviour of Epitaxial-Monolayers under Hertzian Contact

T GYALOG (University of Basel) – Mechanism of Atomic Friction

M BINGGELI (Swith CTR Electr & Microtechnol Inc , Neuchâtel) – Nanotribology at the Solid-Liquid Interface Under Controlled Conditions

A BARATOFF (University of Basel) – Simulations of Scanning Force Microscopy on Alkyl-Thiol Self-Assembled Monolayers

O MARTI (University of Konstanz) – Friction Force Microscope Tool to Investigate Complex Surfaces

H MATSUKAWA (Osaka University) – Theoretical Study of Friction

S BHATTACHARYA (NEC Research Institute, Inc , Princeton) – Friction in Forced Flux Flow in a Disordered Flux Line Lattice

G GRUNER (University of California at Los Angeles) – Friction on a Microscopic Scale Experiments on Density Waves

T V RAMAKRISHNAN (Indian Institute of Sciences, Bangalore) – Relevance of the Fluid State to Large Deformation Behaviour of Solids

F J ELMER (University of Basel) – Is Self-Organized Criticality Possible in Dry Friction?

R L JACOBS (Imperial College, London) – Dynamical Origin of Spatial Order in a Simple System

Poster Session

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Asia	3	2
Europe	5	39
North and Central America		12
Total	*8*	*53*
Grand Total	***61***	
Directors and Lecturers	32	
Participants	29	
Countries represented	20	
Person-months	10.60	
Applications received	72	

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Title: MINIWORKSHOP ON "QUANTUM INCOHERENCE AND QUANTUM COHERENCE IN STRONGLY CORRELATED SYSTEMS"

Dates: 3 - 21 July.

Co-sponsors: European Commission (Brussels, Belgium), Italian National Research Council (CNR), Fondazione IBM Italia, International School for Advanced Studies (SISSA, Trieste, Italy), Istituto nazionale di fisica della materia (INFM, Italian National Institute of Matter Physics).

Directors: Professors G. Baskaran (Institute of Mathematical Sciences, Madras, India), P. Coleman (Rutgers State University, Piscataway, NJ, USA), S. Sachdev (Yale University, New Haven, CT, USA), E. Tosatti (SISSA and ICTP), and Yu Lu (ICTP).

Purpose: To bring together interests in incoherent quantum behaviour with related interests in coherent condensed matter behaviour.

Programme:

S. SOKOL (University of Illinois at Urbana-Champaign, USA) – Quantum and classical phases of doped and large-spin antiferromagnets.

M. ARONSON (University of Michigan, USA) – Non-Fermi liquid scaling of the magnetic response in Uranium intermetallics UCu_5-UPd_5/UBe_{13}

T. GIAMARCHI (Univ. de Paris XI, Orsay, France) – Transport in one dimensional systems.

C. VARMA (AT&T Bell Labs., Murray Hill, USA) – NMR in copper oxide metals.

D. CLARKE (University of Cambridge, UK) – Single particle hopping between Luttinger liquids: A spectral function approach.

SI QIMIAO (University of Illinois at Urbana-Champaign, USA) – Non-Fermi liquid states of a generalized Anderson model: scaling and Toulouse points.

J. KIRTLEY (IBM Thomas J. Watson Research Center, USA) – Half integer flux quanta and the symmetry of the high-T_c superconducting gap.

C. CASTELLANI (Università di Roma La Sapienza, Italy) – Electron-phonon coupling in 1d Hubbard model near half filling.

P. AZARIA (Univ. de Paris VII, France) – Special problems in frustrated magnetism.

D. VOLLHARDT (Rheinisch-West. Tech. Hoch., Aachen, Germany) – Metamagnetism and electronic correlations.

A. NERSESYAN (University of Oxford, UK) – Antiferromagnetic S = 1/2 spin ladder.

P LEE (Massachusetts Inst of Tech , USA) – Photoemission from underdoped cuprates

M ROZENBERG (Ecole Normale Supérieure, Paris, France) – Mott transition in metal oxides a large dimensional approach

A SCHOFIELD (University of Cambridge, UK) – Hunds rule interactions The forgotten force in highly correlated electron systems

N ANDREI (Rutgers State University, USA) – Fermi-liquid and non-fermi-liquid behaviour in the anisotropic Kondo model

M SIECK (Universität Karlsruhe, Germany) – Non-Fermi-liquid behaviour in heavy fermion alloys at a magnetic instability

A GEORGES (Ecole Normale Superieure, France) – Non-Fermi liquid behaviour near a T=0 spin-glass transition

H FUKUYAMA (University of Tokyo, Japan) – Spin and charge excitations and spectral weight near the Mott transition

G AEPPLI (AT&T Bell Labs , Murray Hill, USA) – Obvious disorder and hidden order in a Kagome magnet

A GOGOLIN (Inst Max von Laue-Paul Langevin, Grenoble, France) – Transport properties of quantum wires

S HAYDEN (University of Bristol, UK) – Magnetic excitations in $La_{2-x}Sr_xCuO_4$ up to 2J

A CHUBUKOV (Univ Wisconsin, Madison, USA) – Spin and electronic properties of a nearly antiferromagnetic Fermi liquid

D NEWNS (IBM Thomas J Watson Research Center, USA) – Is weak coupling too naive?

A TIKOFSKY (University of California at Santa Barbara, USA) – BCS - pairing of composite fermions A new even integer QHE

M OGATA (University of Tokyo, Japan) – Collapse of quantized conductance in mesoscopic Tomonaga-Luttinger liquid

Y KITAOKA (Osaka University, Japan) – Magnetic excitation in novel superconductors and quantum coherence in low dimensional spin systems - NMR studies

A TSVELIK (University of Oxford, UK) – New fixed points in the boundary sine-Gordon problem

J K JAIN (State University of New York at Stony Brook, USA) – New developments in the composite fermion theory

K UEDA (University of Tokyo, Japan) – Neel orders, Haldane gap and Kondo spin liquid phase

P COLEMAN (Rutgers State University, USA) – How should we interpret the TWO transport times in the cuprates?

A FINKEL'STEIN (Weizmann Institute of Sciences, Rehovot, Israel) – Resonance in 1d Fermi-edge singularity

G BASKARAN (Institute of Mathematical Sciences, Madras, India) – Origin of effective mass divergence at $\nu = 1/2$ fractional quantized Hall Effect and anomalous excitations

I AFFLECK (University of British Columbia, Vancouver, Canada) – Is there an exponentially large Kondo screening cloud?

E MIRANDA (Florida State University, USA) – Mixed valence and small moment magnetism

G ZIMANYI (University of California at Davis, USA) – Supersolids in strongly correlated systems

S SORELLA (SISSA, Trieste, Italy) – Transition between a Mott insulator and a band insulator in a one-dimensional Hubbard Model

G MURTHY (Boston University, Boston, USA) – Generic incommensurate phases in planar fermionic systems

I DZYALOSHINSKII (University of California, Irvine, USA) – Extended van-Hove singularity and related non-Fermi liquids

F STEGLICH (Technische Hochschule Darmstadt, Germany) – Ce vs U Different routes to heavy fermions? (2 lectures)

J. JAKLIC (Josef Stefan Inst., Ljubljana, Slovenia) – Universality of charge and spin response in doped antiferromagnets.
G. SANTORO (SISSA, Trieste, Italy) – Superconductivity in a chain of Berry phase molecules.
G. LONZARICH (University of Cambridge, UK) – Fermi-liquid vs. non Fermi-liquid states in magnetic metals.
B. DOUCOT (CNRS, Grenoble, France) – Composite Fermions in the $\nu = 1/2$ quantum Hall system and the Aharonov-Casher geometry.
M. FABRIZIO (SISSA, Trieste, Italy) – Some results on coupled Luttinger chains.
G. ZIMANYI (University of California at Davis, USA) – Mean field theory for the localization transition in hard-core Bose systems.
A. PAROLA (Univ. di Milano, Italy) – Superconductivity in models with correlated hoppings.

Plenary Seminars in conjunction with the Research Workshop on Condensed Matter.

Terrace **discussions**: Order parameter symmetry in cuprates. Non-Fermi liquid behaviour in Uranium systems. Incoherence and non-Fermi liquid behaviour in the cuprates.

Short Presentations by Participants.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	1	
Asia	22	5
Europe	33	44
North and Central America		24
South America	4	
International Organizations		2
Total	*60*	*75*
Grand Total	***135***	
Directors and Lecturers	4	
Participants	131	
Countries represented	31	
Int'l Organizations represented	2	
Person-months	52.18	
Applications received	171	

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Title: ADRIATICO RESEARCH CONFERENCE ON CHAOS IN ATOMS AND MOLECULES

Dates: 18 - 21 July.

Co-sponsors: European Commission (Brussels, Belgium) and International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: Professors G. Casati (University of Milan, Como, Italy), S.O. Lundqvist (Chalmers University, Göteborg, Sweden, and ICTP), and N. Rahman (University of Trieste).

Purpose: To analyse the modern developments of quantum chaos and its implications to the

physics of atoms and molecules as well as their behaviour in external fields.

Programme:

B. CHIRIKOV (Institute of Nuclear Physics, Novosibirsk) – Random Matrix Model for Chaotic Atomic States.

E. MAZUR (Harvard University, Cambridge) – Disordering Solids Using Ultrashort Laser Pulses.

F. PICHIERRI (University of Trieste) – Distribution of Vibrational Energy Levels of Triatomic Molecules in the Classically-Chaotic Region.

F. IZRAILEV (University of Crete) – Band Random Matrix Approach to Complex Atoms and Nuclei.

F.H.M. FAISAL (Universität Bielefeld) – Hamiliton-Jacobi Formulation of Quantum Mechanics and the Definition of Quantum Chaos.

R.R.F. GRAHAM (Universität Essen Gesamthochschule) – Dynamical Localization and its Perturbation by Spontaneous Emission in Atomic DeBroglie Waves.

D. SHEPELAYNSKY (Université Paul Sabatier, Toulouse) – Dynamical Localization and Chaos in Excited States.

N. RAHMAN (University of Trieste) – Chaos and High Order Harmonic Generation.

M. RAIZEN (University of Texas at Austin) – Atom Optics: A New Testing Ground for Quantum Chaos.

G. WÜNNER (Ruhr-Universität, Bochum) – Rydberg Atoms in External Fields as an Example of Open Quantum Systems with Classical Chaos.

A. BUCHLEITNER (Max-Planck-Institut für Quantenoptik, Garching) – Classical and Quantum Dynamics in Multiphoton Processes.

A.J. GONZALEZ GARCIA (Universidad Nacional de Colombia) – Improved Semiclasses for the Excited States of Three Particles.

H. HELD (Max-Planck-Institut für Quantenoptik, Garching) – Rubidium Rydberg Atoms in Strong External Fields.

A. PERES (Israel Institute of Technology, Haifa) – Evolution of Liouville Density for Chaotic Systems

L. MATSSON (Göteborg University) – Order from Chaos in Living Cells: A Solution to Growth Signal Firing Problems.

V. AQUILANTI (Università di Perugia) – Quantum and Semiclassical Dynamics of Atomic and Molecular Processes; How to Avoid Classical Chaos and Catastrophes.

V. FLAMBAUM (University of New South Wales) – Structure of Compound States in the Chaotic Spectrum of Ce Atom: Localisation Properties, Matrix Elements and Enhancement of Weak Pertubations, Comparison with Statisical Models.

D. DELANDE (Laboratoire Kastler-Brossel, Paris) – Non-Hydrogenic Atoms in Strong Static External Fields: Order and Chaos.

J. BOTINA (Princeton University) – Intramolecular Dynamics, Dissociation and Control of Triatomic Molecules.

P. LABASTIE (Université Paul Sabatier, Toulouse) – Rydberg States of Molecules Quantum and Classical Motion.

T.S. MONTEIRO (Royal Holloway and Bedford New College, London) – Wigner Functions of Non-Hydrogenic Atoms and Molecules in External Fields.

R. RAMASWAMY (Jawaharlal Nehru University) – Chaos and Complex Dynamics in Finite Atomic Clusters

J. ZAKRZEWSKI (Jagellonian University, Krakow) – Order and Chaos in Microwave Ionization of H Atoms by Circularly Polarized Microwaves.

J. MAHECHA-GOMEZ (Universidad de Antioquia, Medellín) – Hydrogen Atom Between Two Parallel Planes.

J.E. BAYFIELD (University of Pittsburg) – Experimental Studies of Pulse-Induced Quantum

Dynamical Processess that Have Classical Support.
P. SCHNELCHER (Universität Heidelberg) – Two Interacting Charged Particles in Strong Static Fields: A Variety of Two-Body Phenomena.
H. RABITZ (Princeton University) – Getting Control over Molecular Motion.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	3	
Asia	6	2
Europe	7	24
North and Central America	2	5
South America	1	
Total	*19*	*31*
Grand Total	***50***	
Directors and Lecturers	26	
Participants	24	
Countries represented	23	
Person-months	10.18	
Applications received	78	

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Title: AFRICAN REGIONAL WORKSHOP ON PARALLEL PROCESSING AND ITS APPLICATIONS, held in Yaoundé, Cameroon.

Dates: 31 July - 11 August.

Co-sponsor: United Nations University (UNU, Tokyo, Japan).

Directors: Professors V.P. Bhaktar, M.V. Pitke (Tata Institute of Fundamental Research, Bombay, India), and M. Tchuente (University of Yaoundé II, Cameroon).

Purpose: To promote, in the developing countries, scientific excellence in fundamental or applied research areas, requiring high computation power and specialized software environments of parallel computers.

Topics: General: architecture, operating systems, languages, algorithms.
Applications: business (transactions processing, distributed data bases), weather forecasting and climatology, image processing (medicine and remote sensing), physics, chemistry, materials science.

Report: After the solemn ceremony, chaired by the Minister of Higher Education and attended by numerous personalities, such as the Minister of Scientific and Technical Research and the Italian Ambassador, the course started as scheduled. The 9 lecturers from India, Cameroon, France and Gabon presented their lessons during the morning sessions whereas afternoon sessions were dedicated to practical exercises.

Judging from the regular attendance, the numerous questions and the interest for the rich documentation made available, the participants, among which 16 from the subregion and 30 from Cameroon, appreciated very much the teaching which brought up not only the fundamental aspects (e.g. architecture, programming environments, algorithms) but also the applications in mathematics, mechanics, physics, meteorology and chemistry.

During the morning of 5 August, by means of a mini-symposium, participants were given an opportunity to present their own research work. Numerous were the points of convergence which opened possibilities of future collaborations among research workers from the subregion with the scientific support of Indian researchers who have already accumulated a considerable expertise in the field of parallel processing.

On 11 August, during the closing session which was organized in the form of a round table, all participants expressed their gratitude to ICTP, UNU, UNU/IIST, and UYI that made possible such an important scientific event which opened Africa to a high technology domain. They also expressed their interest for the repetition of this kind of workshop in two years' time in Cameroon, and proposed that centres, such as the University of Yaoundé I, which are well equipped and have good research teams, could serve as a link for documentation and receive invited scientists for periods of research.

M.V. Pitke, M. Tchuente

Programme:

M.V. PITKE (Tata Institute of Fundamental Research, Bombay, India) – Architectures.

M. PERIASAMY (C-Dot Telecom Research Centre, Bangalore, India) – Chipps (2 lectures).

H. LEROY (IRISA, Univ. de Beaulieu, Rennes, France) – PVM (2 lectures).

V.M. GOGATE (Center for Development of Telematics, Pune Univ., India) – Basic numerical algorithms (2 lectures).

M.V. PITKE (Tata Institute of Fundamental Research, Bombay, India) – Networking.

M. TCHUENTE (University of Yaoundé II, Cameroon) – Optimization of synchronous systems.

J. KULKARNI (H. Bhabha Atomic Research Centre, Bombay, India) – Atomic applications (2 lectures).

B. PHILIPPE (IRISA, Univ. de Beaulieu, Rennes, France) – Parallel Libraries.

S.K. DASH (Indian Institute of Technology, New Delhi, India) – Weather forecasting (2 lectures).

M. TCHUENTE (University of Yaoundé II, Cameroon) – Combinatorial problems.

H.C. WARRIER (C-Dot Telecom Research Centre, Bangalore, India) – Applications in physics (2 lectures).

P. MOUKELI (Inst. Africain d'Informatique, Libreville, Gabon) – Programming environments (2 lectures).

E. KAMGNIA (Univ. of Yaoundé, Cameroon) – Theory of Monte Carlo methods.

S. YASHONAT (Indian Inst. of Science, Bangalore, India) – Applications in chemistry.

B. PHILIPPE (IRISA, Univ. de Beaulieu, Rennes, France) – Fluid dynamics.

E. KAMGNIA (Univ. of Yaoundé, Cameroon) – Applications of Monte Carlo methods.

S. YASHONAT (Indian Inst. of Science, Bangalore, India) – Molecular dynamics.

M. PERIASAMY (C-Dot Telecom Research Centre, Bangalore, India) – New trends in parallel architectures.

M. TCHUENTE (University of Yaoundé II, Cameroon) – New algorithms issues.

S.K. DASH (Indian Institute of Technology, New Delhi, India) – Some challenging applications.

Laboratory sessions.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	52	
Asia	7	
Europe		2
Total	*59*	*2*
Grand Total	***61***	

Directors and Lecturers	12
Participants	49
Countries represented	18
Person-months	23.82

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Title: MINIWORKSHOP ON JOSEPHSON JUNCTION ARRAYS

Dates: 7 - 11 August.

Co-sponsors: European Commission (brussels, Belgium) and Hitachi Ltd. (Japan).

Directors: Professors S.R. Shenoy (ICTP) and H. Cerdeira (ICTP).

Purpose: To introduce new workers to a rich and developing field, take stock of developments and explore new directions of research.

Programme:

Frustration, Lattice Effects, Disorder

S.R. SHENOY (ICTP Trieste, Italy) – Overview of Josephson Junction Arrays.

B. PANNETIER (CNRS, Grenoble, France) – Imaging of vortices in 2D JJA: Magnetic decoration and other methods.

M. ITZLER (Harvard Univ., Cambridge, USA) – Disorder, quasiperiodicity, anisotropy and commensurability in superconducting wire networks.

E. GRANATO (INPE, São José, Brazil) – Critical behaviour and disorder in frustrated 2D JJA.

S. KORSHUNOV (Landau Inst., Moscow, Russia) – Phase diagram of a Josephson Junction Array with positional disorder.

Vortex Dynamics and Pinning

S. TEITEL (Univ. Rochester, New York, USA) – Vortex lattice melting in 2D JJA.

D. DOMINGUEZ (Los Alamos Nat. Lab., USA) – Dynamics of disordered JJA: Vortex plastic flow and criticality.

P. MARTINOLI (Univ. Neuchâtel, Switzerland) – Probing phase dynamics in Josephson Arrays with regular, fractal and disordered lattice structure.

J. van HIMBERGEN (Universiteit Utrecht, The Netherlands) – Single and collective vortex dynamics in classical JJA.

H. BECK (Univ. Neuchâtel, Switzerland) – Dynamics of ordered and disordered JJA.

P. MINNHAGEN (Umeå University, Sweden) – Anomalous vortex dynamics and current-voltage characteristics in 2D JJA.

Nonlinearity, Chaos, Phase-Locking

K. WIESENFELD (Georgia Inst. Tech., USA) – JJA as nonlinear dynamical systems.

P. LEATH (Rutgers Univ., Piscataway, USA) – Current-driven nonlinear effects in disordered arrays of JJ.

R. MEHROTRA (National Physical Laboratory, New Delhi, India) – Chaos and dynamics of vortices in JJA.

R. NEWROCK (University of Cincinnati, USA) – Integer, Fractional and Subharmonic Giant Shapiro Steps in Two-Dimensional JJA.

D. STROUD (Ohio State University, USA) – Simulations of Giant Shapiro steps in JJA.

S. BENZ (NIST, Boulder, USA) – Phase-locked Josephson Junction oscillators.

Quantum Effects

G. SCHÖN (Universität Karlsruhe, Germany) – Charging effects and quantum phase transitions in JJA.

H. van der ZANT (Delft University of Technology, The Netherlands) – Ballistic behaviour of vortices in quantum capacitive 2D JJA.

J. JOSE' (Northeastern University, Boston, USA) – Coherent quantum states in Arrays of ultrasmall JJ.

M. CHOI (Seoul National University, Korea) – Frustration and quantization in responses of superconducting arrays.

R. FAZIO (Università di Catania, Italy) – One-dimensional JJA.

3D JJA and High-T_c Connection

R. NEWROCK (University of Cincinnati, USA) – Three-dimensional JJA.

T. SCHNEIDER (Univ. Zürich, Switzerland) – 3D-XY-critical behaviour in High-T_c superconductors.

J-M. TRISCONE (Univ. Geneva, Switzerland) – B-T vortex phase diagram in $DyBa_2Cu_3O_7$/$(Y_{1-x}Pr_x)Ba_2Cu_3O_7$ heterostructures.

P. MÜLLER (Universität Erlangen-Nürnberg, Germany) – Layered superconductors as one-dimensional Josephson Arrays.

T. ONOGI (Stanford University, USA) – 3D Simulation of JJA as High-T_c superconductors: Dimensional crossover and nonlinear conductivity.

D. DOMINGUEZ (Los Alamos National Laboratory, USA) – Simulation of current-driven 3D JJA.

Plenary Seminars in conjunction with the Research Workshop on Condensed Matter.

Poster sessions.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	1	
Asia	16	3
Europe	11	32
North and Central America	1	9
South America	9	
International Organizations		2
Total	*38*	*46*
Grand Total	***84***	
Directors and Lecturers	29	
Participants	55	
Countries represented	25	
Int'l Organizations represented	1	
Person-months	15.53	
Applications received	103	

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Title: WORKSHOP ON NONLINEARITY: NOISE IN NONLINEAR SYSTEMS

Dates: 14 - 25 August.

Co-sponsors: European Commission (Brussels, Belgium).

Directors: Professors H. Cerdeira (ICTP), Hu Gang (Beijing Normal University, P.R. China) and F. Marchesoni (University of Camerino, Italy).

Purpose: To discuss the advances in the theory of stochastic resonance and the effect of noise in nonlinear systems.

Programme:

K. WIESENFELD (Georgia Institute of Technology, Atlanta) – Self-Organized Criticality: The Big Picture - I.
F. MARCHESONI (Università degli Studi di Camerino) – Characterization of SR - I.
H. SCHOMERUS (Universität-GH Essen) – University Classes of Spectra - I.
K. WIESENFELD (Georgia Institute of Technology, Atlanta) – Theories of SOC - II.
F. MARCHESONI (Università degli Studi di Camerino) – SR as a Syncronization Mechanism - II.
H. SCHOMERUS (Universität-GH Essen) – Microwave Billards with and without Time Reversal.
K. WIESENFELD (Georgia Institute of Technology, Atlanta) – Open Problems (and hints to possible answers) - III.
F. MARCHESONI (Università degli Studi di Camerino) – Applications - III.
H. SCHOMERUS (Universität-GH Essen) – Semiclassical Approximations.
V. KRAVTSOV (ICTP) – Quantum Coherence and the Universal Conductance Fluctuations - I.
U. WEISS (Universität Stuttgart) – Quantum Dissipative Systems (3 lectures).
V. KRAVTSOV (ICTP) – Mesoscopic Fluctuations of DOS and the Spectral Statistics II.
F. BARAS (Université Libre de Bruxelles) – Statistical Properties of Nonequilibrium Physico-Chemical Systems - Indroduction - I.
V. KRAVTSOV (ICTP) – Mesoscopic Fluctuations of the Amplitude of wave functions - III.
F. BARAS (Université Libre de Bruxelles) – Stochastic Description of Time-Dependent Phenomena: - II.
F. BARAS (Université Libre de Bruxelles) – Microscopic Simulations of Reactive Fluids: - III.

Brief Reports by Participants.

During the period 22-25 August no lectures were scheduled in connection with the Workshop, as it was understood that all participants present would be attending the Adriatico Research Conference: "Randomness Stochasticity and Noise".

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	8	
Asia	12	1
Europe	19	18
North and Central America	2	1
South America	10	
International Organizations		1
Total	*51*	*21*

Grand Total	***72***
Directors and Lecturers	8
Participants	64
Countries represented	30
Int'l Organizations represented	1
Person-months	29.11
Applications received	143

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Title: ADRIATICO RESEARCH CONFERENCE ON CONTEMPORARY CONCEPTS IN CONDENSED MATTER PHYSICS, in honour of Prof. Stig O. Lundqvist's 70th birthday, held in Gothenburg, Sweden.

Dates: 18 - 22 August.

Co-sponsors: Royal Swedish Academy of Sciences through its Nobel Institute for Physics, Nordisk Institut for Teoretisk Atomfysik (NORDITA), the Wenner-Gren Center Foundation for Scientific Research, Chalmers University of Technology, Göteborg University, ICTP Trieste, and Naturvetenskapliga forskningsrådet (NFR).

Organizing Committee: Professors H.A. Cerdeira (ICTP), P. Apell, T. Claeson, M. Jonson, B. Lundqvist, S. Ostlund and G. Wendin (all from Chalmers University, Gothenburg, Sweden).

Purpose: To review and articulate recent concepts and developments in condensed matter physics.

Programme:

B. ALTSHULER (NEC Res. Inst., Princeton, NJ, USA) – From Anderson localization to quantum chaos.

Y. IMRY (Weizmann Inst., Rehovot, Israel) – Delocalization of interacting two-particle states in disordered systems.

D.A. STONE (Yale Univ., New Haven, CT, USA) – Chaotic light: the KAM transition indeformable optical resonators.

P. CHAUDHARI (IBM T.J. Watson Res. Center, Yorktown Heights, NY, USA) – Role of grain boundaries in high temperature superconductivity.

D. SCALAPINO (Univ. of California at Santa Barbara, USA) – Physical properties of metal-oxide ladders.

P. MINNHAGEN (Univ. of Umeå, Sweden)) – Anomalous Langevin dynamics of two-dimensional vortex systems.

M. COHEN (Univ. of California at Berkeley, USA) – A standard model for solids.

O.K. ANDERSEN (Max-Planck-Inst., Stuttgart, Germany) – From the LDA to few-band Hamiltonians for high-temperature superconductors.

M. PARRINELLO (Max-Planck-Inst., Stuttgart, Germany) – Ab-initio molecular dynamics in physics and chemistry.

G. BASKARAN (Inst. of Mathematical Sciences, Madras, India) – Even denominator fractional quantized Hall effect.

A. KARLHEDE (Stockholm Univ., Sweden) – Spin textures in the quantum Hall effect.

A. PINCZUK (AT&T Bell Labs., Murray Hill, NJ, USA) – Light scattering by collective excitations of quantum Hall states.

H. CERDEIRA (ICTP) – Josephson Junction Series Arrays: Spatiotemporal Chaos, Turbulence and

Noise

U von BARTH (Lund Univ , Sweden) – Self consistent GW calculations

C O ALMBLADH (Lund Univ , Sweden) – Extrinsic and intrinsic losses in valence-electron photoemission

R NIEMINEN (Helsinki Univ of Technology, Espoo, Finland) – First-principles simulation of compound semiconductor defects and interfaces

D C LANGRETH (Rutgers Univ , Piscataway, NJ, USA) – Time dependent Anderson model with applications

L HEDIN (Sweden) – *Many-body effects in X-ray absorption spectroscopy*

G GRIMVALL (Stockholm Univ , Sweden) – Ab initio versus semiempirical ("CALPHAD") predictions of transition metal total energies — Resolution of a long-standing discrepancy

V SA-YAKANIT (Chulalongkorn Univ , Bangkok, Thailand) – Path integral approach to the transport theory of quantum Hall

B JOHANNSON (Uppsala Univ , Sweden) – Coherent mesoscopic transport in a microwave field

G SRINIVASAN (Raman Res Inst , Bangalore, India) – An interesting problem in astro-condensed matter

YU Lu (ICTP) – Non-Fermi liquid behavior in a generalized Anderson model

S STENHOLM (Helsinki Univ , Finland) – Stochastic disentanglement of quantum ensembles

R LANDAUER (IBM T J Watson Res Center, Yorktown Heights, NY, USA) – Noise in mesoscopic transport

LU Sham (Univ of California, La Jolla, USA) – Coherence in semiconductors

Y GALPERIN (Oslo Univ , Norway) – Resonant magnetic-tunneling in double-barrier structures Anti-Stokes components

M PAALANEN (Helsinki Univ of Technology, Espoo, Finland) – Thermometry with nanoscale tunnel junctions

J DEVREESE (Belgium) – Bipolarons in high-Tc materials

N MARCH (Oxford Univ , UK) – The exact exchange-correlation potential in terms of density matrices

G MUKHOPADHYAY (Indian Inst of Technology, Bombay, India) – Approximate theories for magnetic susceptibilities and applications to rare earth garnets

N W ASHCROFT (Cornell Univ , Ithaca, NY, USA) – Density Functional Theory in the Classical Domain

L GLAZMAN (Univ of Minnesota, Minneapolis, USA) – Properties of a two-dimensional electron liquid in a weak magnetic field

K A CHAO (Inst for Physics, Trondheim, Norway) – Coulumb interaction in a quantum dot

V AGRANOVICH (Scuola Normale Superiore, Pisa, Italy) – *Organic crystalline nanostructures* new excitations and optical non-linearity

E BURSTEIN (Univ of Pennsylvania, Philadelphia, USA) – The C60 molecule as a quantum dot

O GUNNARSSON (Max-Planck-Inst , Stuttgart, Germany) – Electron-phonon interaction and physical properties of doped C60 compounds

E TOSATTI (Int School for Advanced Studies, SISSA, Trieste, Italy) – Geometrical phase in C60 ions Spectroscopy and superconductivity

G ERTL (Fritz-Haber-Inst , Berlin, Germany) – Nonlinear dynamics in surface reactions

W R SALANECK (Linkoping Univ , Sweden) – Metal atoms on polymer surfaces

J NØRSKOV (Denmark Technical Univ , Lyngby, Denmark) – Predicting the catalytic activity of a metal surface

W KOHN (Univ of California, Santa Barbara, USA) – Nearsightedness

S LUNDQVIST – Summary and concluding remarks

"Concepts in condensed matter in a half-a-century perspective", with contributions from Eli

Burstein and J.R. Schrieffer.

Posters.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Asia	5	1
Europe		31
North and Central America		14
South America	1	
International Organizations		1
Total	*6*	*47*
Grand Total	***53***	
Directors	7	
Participants	46	
Countries represented	14	
Int'l Organizations represented	1	
Person-months	8.68	

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Title: ADRIATICO RESEARCH CONFERENCE ON RANDOMNESS, STOCHASTICITY AND NOISE

Dates: 22 - 25 August.

Co-sponsors: European Commission (Brussels, Belgium) and International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: Professors H. Cerdeira (ICTP), Hu Gang (Beijing Normal University, P.R. China) and F. Marchesoni (University of Camerino, Italy).

Purpose: To provide a forum for a critical cross-disciplinary review of most recent advances.

Programme:

E. POLLAK (The Weizmann Institute of Sciences, Rehovot) – Theory of Activated Rate Processes.

T.G. VENKATESH (Indian Institute of Technology, Delhi) – Bistability and Colored Noise.

J. GARCIA OJALVO (Universitat Politecnica de Catalunya, Terrassa) – External Noise in Extended Systems.

U. WEISS (Universität Stuttgart) – AC Current Noise Through a Point Contact of a Luttinger Liquid.

A. McKANE (University of Manchester) – Path Integrals as a Calculational Tool in the Theory of Stochastic Processes.

B. IVLEV (Universidad Autónoma de San Luis Potosí) – Vortices in Superconductors as a Quantum Dissipative System.

P. HÄNGGI (Universität Augsburg) – Directed Transport: Rocking and Correlation Rachets.

K. LINDENBERG (University of California, San Diego) – Statistical Localization in Nonlinear Systems.

R. MANNELLA (Università degli Studi di Pisa) – From Dynamics to Thermodynamics: Statistical

Mechanics and Brownian Motion.
P.V.E. McCLINTOCK (Lancaster University) – Zero-Dispersion Nonlinear Resonance and Related Phenomena.
M. DYKMAN (Michigan State University) – How Do Large Fluctuations Occur.
J. LUCZKA (University of Slesia, Katowice) – Anomalous Diffusion of Fractal Clusters with Randomly Growing Masses.
R. MANTEGNA (Università degli Studi di Palermo) – Experimental Study of the Escape Times in a Periodically Driven Metastable State.
L. GAMMAITONI (Università degli Studi di Perugia) – Dithering Versus Stochastic Resonance in Threshold Systems.
L. KISS (University of Uppsala) – Stochastic Resonance: Around the Threshold.
C.R. DOERING (Los Almos National Laboratory) – Noise Induced Transport Processes.
L. SCHIMANSKI-GEIER (Humboldt Universität zu Berlin) – Structures by Active Brownian Particles.
M. NEUFELD (Universitat de les Illes Balears, Palma de Mallorca) – Noise Sustained Structures in Convectively Unstable Systems.
HU GANG (Beijing Normal University) – Control of a Complex System by Phase and Noise.
A. VULPIANI (Università degli Studi di Roma "La Sapienza") – On the Concept of Complexity for Random Systems.
H. CERDEIRA (ICTP) – Spatiotemporal Chaos and Noise in rf-Driven Josephson Junction Series Arrays.
P. JUNG (University of Illinois) – Spatiotemporal Stochastic Resonance in Excitable Media.
A. BULSARA (Naval Ocean Systems Center, San Diego) – Noise Induced Syncronization and Resonance in Arrays of Nonlinear Dynamic Elements.
T. MUNAKATA (Kyoto University) – Langevin-Diffusion Equation and Dynamics in Liquids.
H. WIO (Centro Atómico Bariloche) – Aspects of the Anomalous Kinetics of Bi- and Tri-Molecular Diffusion Limited Reactions.
E. VOLKOV (Lebedev Physical Institute, Moscow) – The Influence of Low-Level Noise on the System of Three Coupled Nonlinear Oscillators.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	7	
Asia	14	2
Europe	19	26
North and Central America	4	7
South America	10	
International Organizations		1
Total	*54*	*36*
Grand Total	***90***	
Directors and Lecturers	25	
Participants	65	
Countries represented	35	
Int'l Organizations represented	1	
Person-months	11.60	
Applications received	104	

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Title: ADRIATICO RESEARCH CONFERENCE ON INFORMATION THEORY IN CLASSICAL AND QUANTUM PHYSICS

Dates: 29 August - 1 September.

Co-sponsors: European Commission (Brussels, Belgium) and International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: Professors H.A. Cerdeira (ICTP), H.P.J. Haken (Universität Stuttgart, Germany), and A.N. Proto (Comisión de Investigaciones Científicas-UBA, Buenos Aires, Argentina).

Purpose: To review the state of the art on information theory.

Programme:

Lectures:

O. COSTA DE BEAUREGARD (Institut Henri Poincarè) – On the Joint Probability of Correlated Physical Occurrences.

A. MOHAMMAD-DJAFARI (Ecole Supérieure d'Electricité, Gif sur Yvette) – Data Fusion: Maximum Entropy and Bayesian Approach.

R. FRIEDRICH (Universität Stuttgart) – Analysis of Spatio-temporal Patterns of Complex Systems.

R.G.M. JUMARIE (Université du Quebec, Montreal) – A Maxent Approach to the Entropy of Deterministic Functions. Relation with Liapunov Exponent.

H.G. MILLER (University of Pretoria) – Information Theory and Inverse Problems.

P. MELLO (Universidad Nacional Autónoma de Mexico) – An Information Theoretic Approach to Quantum Chaotic Scattering.

A.N. PROTO (Universidad de Buenos Aires) – Maxtent Procedures in Quantum Mechanics.

C. VERACINI (Università di Pisa) – Maximum Entropy Methods for Orientation and Structure of Molecules Partially Ordered in Liquid Crystal Phases.

A. VOURDAS (University of Liverpool) – Information in Optical Communications with Nonclassical Light.

J.L. GRUVER (Universidad de Buenos Aires) – Decay and Revival in a Quantum System.

M. CASAS (Universitat de les Illes Balears) – Information Theory: An Alternative Approach to the Semiclassical Methods.

C.T. LEE (Alabama Agricultural and Mechanical University, Normal) – Continuous Photodetections and Nonclassical States.

E. LUBKIN (University of Wisconsin, Milwaukee) – The Deeptime Distribution.

V.B. SHEOREY (Physical Research Laboratory, Ahmedabad) – Detection of a Class of Localized States in a Chaotic Quantum System.

Contributions:

R.F. MAMIN (Kazan Physical-Technical Institute) – Self-organization in the Vicinity of Phase Transitions in Ferroelectric-semiconductors.

L. STERGIOULAS (University of Liverpool) – Gabor Expansion: Application of Coherent State Theory to Signal Processing.

L. MATSSON (University of Gothenburg) – Non-equilibrium dose-response, signal firing of growth signal and in superconduction like models.

J. UFFINK (University of Utrecht) – Can the Maximum Entropy Principle be explained as a

consistency requirement?
I. PURICA (Regia Autonoma de Electricitate, RENEL, Bucharest) – Measuring the Experimenter's Knowledge.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	6	
Asia	7	
Europe	7	14
North and Central America	1	4
South America	5	
Total	*26*	*18*
Grand Total	***44***	
Directors and Lecturers	15	
Participants	29	
Countries represented	29	
Person-months	10.8	
Applications received	65	

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Title: WORKSHOP ON PHYSICS AND CHEMISTRY OF TRANSITIONAL METAL OXIDES (including HT_c superconductors), held in Bangalore, India.

Dates: 19 November - 5 December.

In collaboration with Jawaharlal Nehru Centre for Advanced Scientific Research, JNC, Bangalore, India, and Indian Institute of Science, IISc, Bangalore, India.

Directors: Professors C.N.R. Rao (Jawaharlal Nehru Centre for Advanced Scientific Research, JNCASR, Bangalore, India), J. Gopalakrishnan (Indian Institute of Science, IISc, Bangalore, India), A.K. Raychaudhury (IISc, Bangalore) and Dr. F.C. Matacotta (Istituto di spettroscopia molecolare, ISM, Bologna, and ICTP, Trieste, Italy).

Purpose: To let scientists with relevant working experience meet in one of the leading research institutions in the field and interact with a group of outstanding experts in the topics.

Topics:
Structure of oxides and methods of structure determination.
Synthesis and design.
Perovskites, bronzes and various oxide families.
Metal-insulator transitions.
Superconductivity.
Ferroelectricity and related phenomena.
High pressure effects.
Magnetism in oxides.
Glasses.

Report: The lectures broadly covered the topics like structure and chemistry of oxides and the modern methods of structure determination, design and synthesis of oxides, preparation of oxides in ceramic, single crystal and epitaxial forms, physics of electronic states and bands, electron spectroscopy and electronic transport, phenomena like metal-insulator transition,

superconductivity, giant magnetoresistance, ferroelectricity etc. and such issues like glass transition. In addition there were 4 afternoon laboratory sessions where the participants were exposed to different experimental techniques used in studies of oxides. There were also 7 presentations by the participants on the work done by them.

Besides the registrered participants a large number of researchers and students of IISc and JNCASR also attended the lectures and participated in scientific discussions.

A.K. Raychaudhuri, J. Gopalakrishna

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	1	
Asia	34	2
Europe	1	8
North and Central America		2
Total	*36*	*12*
Grand Total	***48***	
Directors and Lecturers	1	
Participants	47	
Countries represented	15	
Person-months	15.97	
Applications received	113	

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PHYSICS OF HIGH AND INTERMEDIATE ENERGIES

Title: RESEARCH IN PHYSICS OF HIGH AND INTERMEDIATE ENERGIES AND ASTROPHYSICS

Dates: Throughout the year.

Organizers: This research programme was organized by the Head of the High Energy Section, S. Randjbar-Daemi, and the other resident senior scientists F. Hussain, K.S. Narain, and J. Strathdee together with consultants E. Gava and R. Iengo, as well as G. Senjanović, A. Smirnov and G. Thompson. The astrophysics part was supervised by D. Sciama and M. Abramowicz.

Purpose: To contribute to the advancement of physics at an international standard through individual and team research, stimulate interaction between physicists from developing and advanced nations, and create genuine research conditions that will encourage Associate Members and visitors from Federated Institutes in their work after their return home.

Seminars *in co-operation with the International School for Advanced Studies (SISSA):*

J. CHKAREULI (CERN and Georgia) – The extended SU(N) guts: unification, families and FC proton decays.

D. BULATOV (SISSA) – 3-dimensional simplicial quantum gravity.

C. IMBIMBO (CERN) – Contact terms and reparametrization invariance in 2-D topological gravity.

S. RANDJBAR-DAEMI (ICTP) – Chiral fermions on the lattice.

A. PROTOGENOV (ICTP) – Random walks over Wilson loop space.

E. AKHMEDOV (ICTP and Moscow) – Nambu-Jona-Lasinio approach to left-right symmetric models.

G. MUSSARDO (SISSA) – Quantum field theory approach to statistical models with impurities.

J. BAEZ (University of California at Riverside) – Higher-dimensional algebra and topological quantum field theory.

J. ELLIS (CERN) – Running hot and cold dark matter.

P. BINETRUY (Orsay) – Models of fermion mass hierarchies.

D. TADIC (Zagreb) – Relativistic (covariant) generalisation of the ISGW quark model.

I. VAYSBURD (SISSA) – RCFT and massive solitons.

M. QUIROS (Madrid and CERN) – Gaugino condensation with field dependent gauge couplings.

A. SEN (TIFR, Bombay) – Duality symmetry in string theory.

M. SCADRON (University of Arizona) – Dimensional regularisation and the linear sigma model.

A. DHAR (CERN) – Discrete-state moduli of 2D string theory from the C=1 matrix model.

K.D. ROTHE (Heidelberg) – Field theoretic realization of the observables in the Ising model.

R. IENGO (SISSA) – Quantum nucleation of vortices in thin superconductors by QFT approach.

E. SHABALIN (Moscow) – CP and CPT — A theoretical overview.

D. KREIMER (Mainz) – Knots and divergences.

E. GAVA (INFN) – N=2 heterotic-type II string duality.

A. SCHWIMMER (SISSA) – Landau-Ginzburg superpotentials and non-abelian duality.

I. ANTONIADIS (Ecole Polytechnique, Paris) – Tests of string-string duality.

V.K. DOBREV (Sofia) – Conformal quantum group, q-Minkowski space and infinite hierarchies of q-Maxwell equations.

G. ALDAZABAL (Madrid) – Building guts from superstrings.

M. VYSOTSKY (ITEP, Moscow, and Ferrara) – Higgs potential bounds on extra quark-lepton generations.

C. MUNOZ (Universidad Autónoma de Madrid) – Charge, color and supersymmetry breaking and strings.

Joint Informal Seminars *in co-operation with the Department of Theoretical Physics of the University of Trieste:*

A. SHIEKH (ICTP) – Quantum canonical transformations revisited.

K. BENAKLI (ICTP) – Perturbative SUSY breaking and large extra dimension(s) in superstring theory.

M. AHMADY (Western Ontario) – Two photon decay of η_c and η_b.

C. NUNEZ (IAFE, Buenos Aires) – Quantum corrections and external 2D black holes.

T. BIBILASHVILI (Tbilisi) – Real-time quantum field theory in the inhomogeneous media.

H. TERAZAWA (INS, Univ. of Tokyo) – Dirac's large number hypothesis in the Friedmann cosmology.

A. LUDU (J.W. Goethe Universität, Frankfurt) – q-differential realisation of quantum algebras and wavelets.

Z. HASIEWICZ (Wroclaw) – Classical and quantum strings in non-critical dimensions (1<d<25).

A. BASHIR (Durham) – Dyson-Schwinger equations: perturbation theory, multiplicative renormalizability and gauge invariance as guides to their non-perturbative truncation.

G. EFIMOV (Dubna) – Nambu-Jona-Lasinio model with the homogeneous background gluon field.

A. SAMOKHIN (Protvino) – Do we really observe genuine diffractive phenomena in high energy collisions?

V. GERSHUN (Kharkov) – Matched differential calculus on the $GL_q(2,C)$, $SL_q(2,C)$ and $C_q(2/0)$ and two- and 1-dimensional models on the $SL_q(2,R)$ quantum group.

V.S. ZAMIRALOV (Moscow St. Univ.) – Gottfried integral and modified valence quark contribution.

Chao-Shang HUANG (Beijing) – *I/M expansion in BS approach.*

E. ABDALLA (ICTP) – Towards solution of 2-dimensional QCD.

E. NARDI (Weizmann Inst.) – First limit on inclusive $B \to X_s \bar{\nu}\nu$ decay and constraints on new physics.

V.A. SOROKA (Kharkov Inst.) – Description of dynamics based on the anti-bracket.

Series of lectures

by GC. GHIRARDI (Department of Theoretical Physics of the University of Trieste) – Foundations of quantum mechanics.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	22	
Asia	62	5
Europe	72	41
North and Central America	2	6
South America	11	
International Organizations		22
Total	*169*	*74*
Grand Total	***243***	
Countries represented	74	
Int'l Organizations represented	4	
Person-months	464.71	
Applications received	245	

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Title: RESEARCH IN PLASMA PHYSICS

Dates: Throughout the year.

Director: Professor S. Mahajan (University of Texas at Austin, USA, and ICTP).

Purpose: To promote collaboration between plasma physics researchers in developing and developed countries and to provide them with research facilities (library and computing) to enable them to conduct first-rate research work in plasma physics.

Seminars:

H.L. BERK (University of Texas, Austin, USA) – Weak plasma turbulence theory of a driven system.

R.B. WHITE (Princeton University, USA) – Nonlinear behaviour of toroidal Alfven modes.

C. UBEROI (Indian Institute of Science, Bangalore, India) – Some recent studies of resonant absorption of Alfven waves.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	2	
Asia	6	
Europe	4	2
North and Central America		4
South America	2	
International Organizations		1
Total	*14*	*7*
Grand Total	***21***	
Countries represented	15	
Int'l Organizations represented	1	
Person-months	69.6	

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Title: SPRING SCHOOL AND WORKSHOP ON STRING THEORY, GAUGE THEORY AND QUANTUM GRAVITY

Dates: 27 March - 7 April.

Directors: Professors R. Dijkgraaf (University of Amsterdam, The Netherlands), R. Iengo (SISSA and ICTP), I. Klebanov (Princeton University, USA), K.S. Narain (ICTP) and S. Randjbar-Daemi (ICTP).

Purpose: To provide pedagogical treatment of the topics.

Topics: String phenomenology.
Supersymmetry.
S-duality.
Large N techniques.
Quantum gravity.
Black holes.

Topological field theory.

Programme:

Spring School (27 March - 4 April):

J. POLCHINSKI (ITP, S. Barbara) – Introduction to string theory and matrix models (5 lectures).

I. KLEBANOV (Princeton University) – Baby universes, matrix models and Liouville gravity (3 lectures).

P. FRE (SISSA) – Special geometry in N=2 supersymmetry (4 lectures).

A. SEN (TIFR, Bombay) – Duality invariance in supersymmetric string theories in dimensions less than or equal to 4 (5 lectures).

N. SEIBERG (Rutgers University and IAS, Princeton) – Four-dimensional supersymmetric field theory (6 lectures).

R. DIJKGRAAF – (University of Amsterdam) – 4-manifolds and gauge theories (3 lectures).

T. EGUCHI (University of Tokyo) – Topological sigma-models and large-N matrix integral (3 lectures).

L. SUSSKIND (Stanford University) – Black holes, strings, holograms and complementarity (5 lectures).

Workshop (5 - 7 April):

S. WADIA (TIFR, Bombay) – Quark confinement in 2+1 dimensional pure Yang-Mills theory.

R. GOPAKUMAR (Princeton Univ.) – Mastering the master field.

H. ISHIKAWA (Univ. of Tokyo) – Topological structure in c=1 string theory.

K.S. NARAIN (ICTP) – Monodromy of perturbative prepotential in N=2 heterotic strings.

Sumit DAS (TIFR, Bombay) – Geometric entropy and two-dimensional strings.

E. CACERES (Univ. of Texas at Austin) – On the impossibility of large radius compactification in realistic string theory.

E. KIRITSIS (CERN) – One loop calculation of coupling constants in string theory.

D. LUST (Humboldt Univ., Berlin) – Duality symmetries and threshold effects in N=2 heterotic string compactifications.

R. EMPARAN (Univ. Pais Vasco) – Quantum black hole entropy.

A. VAN PROEYEN (Katholieke Univ. Leuven) – Special geometry and symplectic transformations.

P. TOWNSEND (Univ. of Cambridge) – Type II superstrings: from 10 to 11 dimensions.

I. BANDOS (Kharkov Institute) – Generalized action principle for superstrings and supermembranes.

L. GIRARDELLO (Univ. of Milan) – S-duality in N=4 super Yang-Mills theories.

S. NISHIGAKI (TECHNION, Haifa) – Renormalization group flow in matrix models.

D.V. BOULATOV (SISSA) – One-dimensional dynamics of QCD_2 string.

A. DHAR (CERN) – String beta function equations from the c=1 matrix model.

J. SCHNITTGER (CERN) – Status of operator approach to Liouville theory.

A. ALI (Inst. of Mathematical Sciences, Madras) – Duality invariant superstring actions.

S. DALLEY (Oxford Univ.) – Strings, glueballs and 2D light-front QCD.

J. MALDACENA (Princeton Univ.) – Boundary conformal field theory and open strings.

Saurya DAS (Inst. of Math. Sciences, Madras) – Aspects of Planckian scattering beyond the Eikonal.

M. O'LOUGHLIN (Univ. of Chicago) – Boundary conditions in c=1 matrix model.

T. TADA (Univ. of California, S. Barbara) – Consequence of 2D black hole evaporation.

J-S. PARK (Univ. of Wales, Swansea) – N=2 supersymmetric QCD and four manifolds.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	2	
Asia	19	8
Europe	24	69
Indonesia and Oceania		3
North and Central America	2	16
South America	14	
International Organizations		12
Total	*61*	*108*
Grand Total	***169***	
Directors and Lecturers	17	
Participants	152	
Countries represented	37	
Int'l Organizations represented	3	
Person-months	69.62	
Applications received	252	

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Title: CONFERENCE ON RECENT DEVELOPMENTS IN STATISTICAL MECHANICS AND QUANTUM FIELD THEORY

Dates: 10 - 12 April.

Co-sponsors: International School for Advanced Studies (SISSA, Trieste, Italy) and Italian National Institute for Nuclear Physics (INFN).

Directors: Professors L. Bonora (SISSA), J.L. Cardy (University of Oxford, UK), G. Mussardo (SISSA), S. Randjbar-Daemi (ICTP), and H. Saleur (University of Southern California, Los Angeles, CA, USA).

Purpose: To bring together leading experts in different topics of common interest in statistical mechanics and quantum field theory, and to present surveys of the current status of these topics, suitable for non-specialists, and to provide an appropriate forum for fruitful discussions between participants.

Topics:
Random surfaces and polymers.
Two-dimensional S-matrix.
Integrable quantum field theory.
Boundary quantum field theory.
Conformal field theory.
Quantum chaos and matrix models.

Programme:

E. BREZIN (ENS, Paris) – *Universality of the correlations between eigenvalues of large random* matrices.

B.D. SIMONS (Imperial College, London) – Universality in quantum chaos: theory and application.

B. DERRIDA (ENS, Paris) – Systems out of equilibrium: exactly soluble cases in one dimension.

B. DUPLANTIER (CEN - Saclay) – Renormalization theory for tethered membranes.

I.K. KOSTOV (CEN - Saclay) – Solvable statistical models on random lattices.

A. BILAL (Ecole Normale Supérieure, Paris) – Non-local extensions of the conformal algebra.
A. CAPPELLI (Univ. Florence) – W-infinity minimal models and the hierarchy of the quantum Hall effect.
M. CASELLE (Univ. Turin) – Calogero-Sutherland techniques in the physics of disordered wires.
C. CALLAN (IAS, Princeton) – Some curious applications of boundary field theory, conformal and otherwise.
P. FENDLEY (Univ. of Southern California) – Exactly solvable and experimentally measurable field theory of Hall edges.
A. LUDWIG (Univ. of California, Santa Barbara) – Quantum impurity problems.
N. READ (Yale) – Quantum spin glasses.
T. HOLLOWOOD (Univ. Wales, Swansea) – Exact mass-gaps in some asymptotically-free theories.
S. PALLUA (Univ. Zagreb) – Closed quantum group invariant spin chain.
M. PICCO (Univ. Paris VI) – Correlation functions for the 2-dim. random bond Potts models.
N. WARNER (Univ. Southern California) – Supersymmetry in integrable boundary field theories.
B.M. McCOY (SUNY) – Fermionic representations of conformal field theory.
V. PASQUIER (CEN - Saclay) – The Calogero and Haldane models.
D. ABRAHAM (ENS, Paris) – Corner transfer matrix and magnetization in Ising model.
A. POLYCHRONAKOS (CERN) – Probabilities and path-integral realisation of exclusion statistics.
D. OLIVE (Swansea) – Duality and solitons.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia	8	2
Europe	13	57
North and Central America		11
South America	4	
International Organizations		5
Total	*28*	*75*
Grand Total	***103***	
Directors and Lecturers	19	
Participants	84	
Countries represented	28	
Int'l Organizations represented	3	
Person-months	19.57	
Applications received	150	

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Title: CONFERENCE ON PERSPECTIVES IN NUCLEAR PHYSICS AT INTERMEDIATE ENERGY

Dates: 8 - 12 May.

Co-sponsors: Italian National Institute for Nuclear Physics (INFN).

Directors: Professors S. Boffi (University of Pavia, Italy), C. Ciofi degli Atti (University of Perugia, Italy), and M. Giannini (INFN at University of Genoa, Italy).

Purpose: To review recent advances and explore future trends in the topics.

Topics: Nucleon form factors.
Excited baryons and mesons.
Few-body systems.
Correlations in nuclei.
Sum rules.
Relativistic many-body approaches.
Deep inelastic scattering.
Spin structure of hadrons and nuclei.

Programme:

G. RIDOLFI (CERN) – The spin structure functions: a theoretical survey.

A. DYRING (Uppsala) – Recent NMC data.

G. BAUM (Bielefeld) – The SMC experiment.

K. GRIFFIOEN (Williamsburg) – The E143 experiment.

M. VETTERLI (DESY) – The HERMES experiment.

A. FELTHMAN (Basel) – Recent developments in Moeller polarimetry.

O. HANSEN (Argonne Nat. Lab.) – ^{3}He(e,e')X and the neutron form factors.

Th. BAUER (R.J. van de Graaff Lab., Utrecht) – Recent measurements of the neutron magnetic form factor.

E. PACE (Rome) – The spin dependent spectral function of ^{3}He.

N. PAVEL (DESY) – DESY.

S. KULAGIN (Moscow) – Theory of DIS from polarised deuterons.

S. CAPSTICK (Florida State) – Form factors within the constituent quark model.

G. SALME' (Rome) – Light cone calculations of meson and baryon form factors.

L. GLOZMAN (Graz) – Systematics of light and strange baryons and the symmetries of QCD.

E. SANTOPINTO (Genoa) – Quark models in hadronic systems.

V. VENTO (Valencia) – Spin structure function and constituent quarks.

A. SVARC (Zagreb) – Partial wave analysis for πN-πN, πN-ηN, ηN-ηN processes.

K. SISTEMICH (Kfa, Jülich) – COSY.

C.W. de JAGER (Nat. Inst. voor Kernfysica en Hoge Energie Fysica, NIKHEF, Amsterdam) – Asymmetries in elastic scattering and (e,e'p) from tensor polarized deuterium.

A. DE PACE (INFN, Turin) – The parity-violating longitudinal response.

G. CATTAPAN (Padua) – A constructive approach to the coupled (pion-NNN)-NNN problem.

P. PEDRONI (Pavia) – Double-pion photoproduction up to 800 MeV at Mainz.

R. BECK (Mainz) – E2/M1 in N-Δ transitions.

C. SCHÄRF (Rome) – Compton scattering on ^{4}He.

V. MUCCIFORA (Frascati) – Total photoabsorption in nuclei.

M. JODICE (Rome) – (e,e'K) at CEBAF.

M. RIPANI (Genoa) – Analysis of the data from a Jet target electron scattering experiment in the quasielastic region.

G. van der STEENHOVEN (NIKHEF) – Probing NN correlations by virtual photons.

T. TERASAWA (Sendai) – (γ,n) reactions above giant resonance.

D. MacGREGOR (Glasgow) – Probing NN correlations by real photons.

F.D. PACATI (Pavia) – NN correlations in one- and two-nucleon knockout.

W. DICKHOFF (St. Louis) – One- and two-nucleon removal and short-range correlations.

A. POLLS (Barcelona) – Calculation of natural orbits in finite nuclei.

T. HEHL (Tübingen) – Experimental study of (γ,NN) reactions at MAMI-B.

M. VIVIANI (Pisa) – NN correlations in few-body systems.

W. LEIDEMANN (Trento) – The electron scattering response from integral transforms.

N.N. NIKOLAEV (Jülich) – NN correlations and final state interaction.
M. STOITSOV (Sofia) – Restoring the overlap functions and spectroscopic factors on the base of one-body density matrix.
M.K. GAIDAROV (Sofia) – Realistic one-body density matrix in nuclei.
R.A. ERAMZHYAN (Moscow) – Nuclear structure effects in polarization observables in pion photoproduction and pion scattering off light nuclei.
E. MAVROMMATIS (Athens) – FHNC/0 calculation of the half diagonal two-body density matrix of model nuclear matter.
F. IACHELLO (Yale) – Algebraic approach to the baryon spectrum.
S. SCOPETTA (Perugia) – Excitation of nucleon resonances in polarised scattering.
A. BUCHMANN (Tübingen) – Electromagnetic properties of one- and two-baryon systems in the nonrelativistic quark model.
S. SCHERER (Mainz) – Virtual Compton scattering.
R. CENNI (Genoa) – Electron-scattering in the Δ region.
L. TIATOR (Mainz) – Photon- and pion-induced reactions on the trinucleon.
T. BRESSANI (Turin) – The FINUDA experiment at DAΦNE.

Round Table on Relativistic Approaches to Hadrons and Nuclei at Intermediate Energies.

Laboratory Reports:
P.K.A. De Witt Huberts – NIKHEF.
S. Kowalski – MIT-Bates.
W. Meyer – ELSA.
D. Skopik – Saskatchewan.
W. Boeglin – MAMI.
J.-M. Laget – ELFE.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia		2
Europe	13	65
North and Central America	1	12
International Organizations		1
Total	*16*	*80*
Grand Total	***96***	
Directors and Lecturers	67	
Participants	29	
Countries represented	23	
Int'l Organizations represented	1	
Person-months	20.05	
Applications received	139	

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Title: TRIESTE CONFERENCE ON S-DUALITY AND MIRROR SYMMETRY

Dates: 5 - 9 June.

Directors: E. Gava (Istituto Nazionale di Fisica Nucleare, INFN, Trieste, Italy, and ICTP), K.S. Narain (ICTP) and C. Vafa (Harvard University, Cambridge, MA, USA).

Purpose: To bring together physicists and mathematicians active in research areas relevant to S-duality and mirror symmetry; to provide an overview of the current status of these topics and to offer an opportunity for fruitful interactions between participants.

Report: This Conference occurred at a moment when string theory is providing new exciting developments, related precisely to Mirror Symmetry and S-Duality. This is best witnessed by the words of E. Witten in his closing talk, where he said that "This is one of the most exciting conferences I have ever participated in".

As reviewed by D. Olive in his opening talk, the idea of electric-magnetic and strong-weak coupling duality symmetry was first proposed in the late seventies by Montonen and Olive in the context of certain quantum field theories possessing magnetic monopole solutions. This conjecture was based on a striking similarity between the magnetic interactions and electric interactions observed in those models. It was immediately realized that the best candidates for self-dual theories were the N=4 supersymmetric Yang-Mills theories, due to their peculiar non-renormalization properties.

The issue was reconsidered about one year ago by A. Sen, who proved that the prediction of duality symmetry in N=4 theories, concerning the spectrum of BPS-saturated states was indeed verified, at least in the sector of magnetic charge 2. The above prediction was then verified in the general case and further evidences for duality in N=4 theories were subsequently found by other authors. At the same time the S-duality symmetry was explored in the N=4 heterotic string by J. Schwarz and A. Sen.

In Summer '94, Seiberg and Witten made a spectacular progress applying duality ideas to the N=2 gauge theories. They postulated the occurrence of massless monopoles at some point in the parameter space of those theories, and this allowed them to compute exactly their low energy effective action, including non-perturbative corrections. This result had also a dramatic impact on the Mathematics side, providing much simpler theory of 4-manifold invariants, as compared to the celebrated Donaldson theory. In his talk, E. Witten gave a beautiful physical interpretation of some recent results in the mathematical literature.

The highlights of the Conference, however, had mainly to do with some new developments concerning String Theory which took place during Spring '95.

In fact, A. Strominger applied Seiberg-Witten ideas to the N=2, type II string compactified on a Calabi-Yau manifold. He proposed a resolution of the so-called "conifold puzzle" in string theory, which again involved the appearance of massless solitonic states, this time charged black-holes. According to his proposal these states would be responsible for the singularities (called conifold singularities) appearing in the low energy effective action when the C.-Y. manifold itself becomes singular. These singularities are a generic feature of the low energy effective theory as computed using Mirror Symmetry and signal breakdown of the low energy description. Strominger interprets them as due to a loop of massless charged black-holes. The idea that (BPS) black-holes have to be treated as elementary states goes back to S. Hawking, A. Salam and others and was the subject of the talk of A. Sen, who argued that indeed the entropy in BPS black-holes agrees with the multiplicity of elementary string states.

At a conceptual level Strominger's idea has a satisfying consequence, as pointed out by B. Greene, A. Strominger and D. Morrison: they argued that the condensation of these black-holes would allow a smooth transition between topologically distinct C.-Y. spaces, i.e. between vacua with different low energy spectra. This idea would then essentially unify all C.-Y. compactifications, in agreement with similar proposals coming from the mathematical side and due to M. Kontsevich. All of these developments were reviewed in the Conference in the talks of Strominger, Greene, Morrison and Kontsevich.

In parallel to these developments, the program of extending Seiberg-Witten approach to the heterotic N=2 case was accomplished, especially due to some work of Kachru and Vafa, which C. Vafa reviewed at the Conference. They in fact proposed a duality between type II and heterotic

string with N=2 supersymmetry, giving also some explicit examples of dual pairs. The most interesting upshot of this proposal is that Mirror Symmetry, used to compute world-sheet non-perturbative effects on the type II side, computes also nonperturbative spacetime corrections on the heterotic side. This led some authors to use the words "second quantized Mirror Symmetry".

S. Ferrara, J. Harvey and K.S. Narain reviewed some further developments in this context and some successful tests of the N=2 type II-heterotic duality in some explicit examples. There were other interesting talks on various aspects of String-String duality and extensions of Seiberg-Witten work within field theory.

In conclusion, the picture emerging from the Conference is that String Theory has received an extraordinary fertilization from duality ideas. From the computational point of view, it seems that non-perturbative issues are becoming accessible and from the conceptual point of view it seems that various different String Theories (as suggested by Witten, even 11-dimensional supergravity!) are actually different realizations of the same Theory.

E. Gava

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	3	
Asia	14	9
Europe	10	37
Indonesia and Oceania	1	
North and Central America	1	27
South America	2	
International Organizations		9
Total	*31*	*82*
Grand Total	***113***	
Directors and Lecturers	32	
Participants	81	
Countries represented	27	
Int'l Organizations represented	3	
Person-months	22.39	
Applications received	221	

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Title: SUMMER SCHOOL IN HIGH ENERGY PHYSICS AND COSMOLOGY including Workshop on strings, gravity and related topics (29 - 30 June)

Dates: 12 June - 28 July.

Co-sponsors: International School for Advanced Studies (SISSA, Trieste, Italy) and Italian National Institute for Nuclear Physics (INFN).

Directors: Professors E. Gava (Italian National Institute of Nuclear Physics, INFN, Trieste, Italy, and ICTP), A. Masiero (Italian National Institute of Nuclear Physics, INFN, Padua, Italy), K.S. Narain (ICTP), S. Randjbar-Daemi (ICTP) and Q. Shafi (University of Delaware, Newark, USA).

Purpose: To provide a stimulating environment for presenting topics of current interest in high energy physics and cosmology.

Programme:

Summer School, Part 1 (12 - 28 June):

B. GREENE (Cornell University) – Basics of CFT, string compacifications, mirrors etc. (6 lectures).

J. HARVEY (University of Chicago) – Monopole solutions in supersymmetric theories (5 lectures).

A. VAN PROEYEN (Katholieke Universiteit Leuven) – N=2 supersymmetry (3 lectures).

L. ALVAREZ-GAUME (CERN) – Recent developments in supersymmetric N=2 Yang-Mills (5 lectures).

K. INTRILIGATOR (Rutgers University) – Exact results in supersymmetric gauge theories (5 lectures).

M. BERSHADSKY (Harvard University) – Review of 2d SUSY Sigma models and relation to 4d gauge theories (4 lectures).

G. THOMPSON (ICTP) – Some recent results in topological field theory (4 lectures).

H.P. NILLES (Technische Univ., Munich) – Superstring phenomenology (4 lectures).

Workshop (29 - 30 June):

H.P. NILLES (Technischen Univ., Munich) – Gaugino condensation and the vacuum expectation value of the dilaton.

B. DE WIT (University of Utrecht) – Applications in special geometry.

K. BENAKLI (ICTP) – About SU(3) x SU(2) x U(1) string models with large extra dimension.

K. RAY (Institute of Physics, Bhubaneswar) – Symmetries of heterotic string theory.

D. GHOSHAL (Mehta Research Institute, Allahabad) – Universal topological theory near a conifold and the $c = 1$ string.

J. FIGUEROA-O'FARRILL (London University) – Are all TCFTs obtained by twisting N=2 SCFTs.

A. KLEMM (CERN) – Symmetries of string compactifications on Calabi-Yau threefolds.

E. ABDALLA (CERN, Geneva) – Towards solution on QCD in two dimensions.

A. CERESOLE (Politecnico di Torino) – Dualities of local versus rigid N=2 Yang-Mills theories.

I. ANTONIADIS (Ecole Polytechnique, Palaiseau) – Perturbative prepotential in N=2 heterotic strings.

S. KETOV (University of Hannover) – The string measure and spectral flow of critical N=2 strings.

K. BEHRNDT (Humboldt-Univ., Berlin) – S and T duality in the compactified chiral null model.

C. POPE (Texas A & M University) – The N=2 string in a real spacetime structure.

S.F. HASSAN (CERN, Geneva) – T-duality and non-local supersymmetries.

S. MAHAPATRA (Utkal University, Bhubaneswar) – Duality and string theoretic inflation.

E. SEZGIN (Texas A & M University) – Search for N=2 strings with spacetime supersymmetry.

School, Part 2 (3 - 28 July):

C. VERZEGNASSI (Univ. of Lecce) – Introduction to the standard electroweak model (3 lectures).

I. HINCHLIFFE (Lawrence Berkeley Lab.) – QCD and related topics (5 lectures).

S. BERTOLINI (SISSA) – Introduction to GUTS (3 lectures).

A. MASIERO (University of Padua) – Introduction to supersymmetry and MSSM (3 lectures).

S. RANDJBAR-DAEMI (ICTP) – Chiral fermions on the lattice (2 lectures).

B. KAYSER (Fermilab, Batavia) – CP Violation (4 lectures).

C. REBBI (Boston University) – Review of lattice QCD (2 lectures).

A. SMIRNOV (ICTP) – Neutrino physics (3 lectures).

G. DVALI (Univ. of Pisa) – Supersymmetry/supersymmetric GUTS (2 lectures).

M. VOLOSHIN (University of Minnesota) – Non-perturbative methods and electroweak physics (5 lectures).

J. STONE (Boston University) – Proton decay searches.

G. ZOUPANOS (National Technical University, Athens) – Gauge Yukawa unification and the mass of the top quark.
R. SINGLETON (Boston University) – Baryon number non-conservation in high energy electroweak processes.
E. KOLB (Fermi National Accelerator Lab.) – The early universe (3 lectures).
C. GIACOMELLI (University of Bologna) – MACRO experiment at Gran Sasso.
M. BALDO CEOLIN (University of Padua) – Neutrino telescopes.
J. LYKKEN (Fermi National Accelerator Lab.) – 4-d superstring models (5 lectures).
R. SCHAEFER (Bartol Research Institute) – Large scale structure: Theory versus observations.
Q. SHAFI (University of Delaware) – Proton decay, magnetic monopoles and all that.
M. NAKAHATA (University of Tokyo) – Kamiokande and superkamiokande.
K. KONDO (University of Tsukuba) – Top quark search at the Tevatron.
K. KONDO – Susy search at Fermilab.
Z. BEREZHIANI (Georgian Academy of Sciences) – Fermion masses and mixings.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	21	
Asia	58	3
Europe	44	37
Indonesia and Oceania	2	1
North and Central America	3	25
South America	18	
International Organizations		11
Total	*146*	*77*
Grand Total	***223***	
Directors and Lecturers	37	
Participants	186	
Countries represented	45	
Int'l Organizations represented	3	
Person-months	194.61	
Applications received	422	

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Title: FOURTH SCHOOL ON NON-ACCELERATOR PARTICLE ASTROPHYSICS

Dates: 17 - 28 July.

Co-sponsor: Italian National Institute of Nuclear Physics (INFN).

Directors: Professors E. Bellotti (University of Milan, Italy), R. Carrigan (Fermi National Accelerator Laboratory, Batavia, IL, USA), G. Giacomelli (University of Bologna, Italy), N. Paver (University of Trieste and INFN), and J. Stone (Boston University, MA, USA).

Purpose: To provide lectures on theory, experimental methods, present status of experiments, and future theoretical and experimental expectations.

Report: This School was attended by 92 participants from several countries, actively working in the field of non-accelerator particle physics and astrophysics, either theoreticians or experimentalists. Some physicists already present at the ICTP and at the University of Trieste also took part. The students were mostly at the Ph.D. or at the postdoctoral level, and came from Algeria, Argentina, Belarus, Bangladesh, Benin, Bolivia, Brazil, Bulgaria, Canada, Denmark, Egypt, France, Georgia, Germany, India, Iran, Italy, Japan, Mali, Morocco, New Zealand, Nigeria, Pakistan, Poland, Romania, Russia, Slovak Republic, Spain, Sri Lanka, Turkey, Ukraine and USA, so that quite a considerable number of nations were represented in this activity.

The School consisted of a series of keynote lectures on subjects relevant to the field of non-accelerator particle astrophysics, presenting the theory, the experimental methods and the future theoretical and experimental perspectives. The topics covered were: the standard model of particle physics and models beyond the standard model, neutrino masses and oscillations, solar and supernovae neutrinos, proton decay, double β decay, cosmological models, properties and models of dark matter, neutrino astronomy, the origin of cosmic rays and their composition, astroparticle physics with space stations, muon and gamma-ray astronomy, air shower physics, magnetic monopoles and gravitational waves. Moreover, results from accelerator experiments were also reviewed, to give students a complete background. Representatives of large experiments and laboratories gave talks on their present and future programmes. For each subject, ample time was devoted to discussing the theory as well as related experiments in details. Discussion sessions were very lively, with many questions to the speakers and comments from the participants. One afternoon was devoted to training students to the practical use of networks and databases, Internet in particular.

Lectures were given by: M. Baldo Ceolin, G. Barbiellini, G. Battistoni, F. Bobisut, M. Cerdonio, A. Chiavassa, E. Fiorini, M. Ghia, G. Giacomelli, R. Giacomelli, A. Masiero, G. Mandrioli, P. Monacelli, O. Palamara, N. Paver, E. Previtali (Italian institutions and INFN); M. Persic, S. Petcov (SISSA); G.F. Giudice, F. Pietropaolo (CERN); R. Carrigan, E. Kolb (Fermilab); A. Colavita (ICTP); J. Stone (Boston Univ.); M. Nakahata (Tokyo Univ.); K. Kondo (Tsukuba Univ.); D. Vignaud (Saclay).

Poster sessions were organized, and totalled 16 posters presented by the students. Furthermore, in addition to discussion sessions, some fraction of the time was devoted to library and study time. All that created the atmosphere of a research school.

While xerox copies of the transparencies of all lectures were distributed to participants in real time, it is now planned to publish the proceedings of the School in a book by World Scientific, edited by the organizers.

In the concluding session there was a short discussion on the scientific structure of the School and problems connected to the organization. Participants expressed their deep appreciation for the formulation of the physics programme. The usefulness and the formative character of the School was recognized, especially by the physicists from developing countries, and it was suggested that the School should be repeated with a two-year frequency. Many students suggested to investigate the possibility of organizing a short visit to some laboratory specialized in this field, immediately following the School.

G. Giacomelli, N. Paver

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	6	
Asia	11	3
Europe	24	42
North and Central America		6
South America	5	
International Organizations		2
Total	*46*	*53*
Grand Total	***99***	

Directors and Lecturers	27
Participants	72
Countries represented	32
Int'l Organizations represented	2
Person-months	35.21
Applications received	147

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Title: AUTUMN COLLEGE ON PLASMA PHYSICS

Dates: 18 September - 13 October.

Directors: Professors B. Buti (National Physical Laboratory, New Delhi, India), S.M. Mahajan (University of Texas at Austin, USA), and P.H. Sakanaka (Universidade Estadual de Campinas, Brazil).

Purpose: To discuss nonlinear plasmas.

Programme:

Z. YOSHIDA (Univ. of Tokyo, Japan) – Convective Derivatives Arising in Plasma Physics and Related Phenomena (2 lectures).

S. KIDA (Kyoto Univ., Japan) – Statistical Theory of Turbulence.

F. ROMANELLI (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Frascati, Italy) – Electrostatic Two-Fluids Model and Basic Destabilization Mechanisms.

F. ROMANELLI (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Frascati, Italy) – Non-Local Analysis of Electrostatic Microinstabilities.

S. KIDA (Kyoto Univ., Japan) – Statistical Theory and Vortex Dynamics in Turbulence.

A. RUKHADZE (General Physics Inst., Moscow, Russia) – Principles of Electrodynamics of Media With Spatial Dispersion.

T. SATO (Nat. Inst. for Fusion Studies, Nagoya, Japan) – Complexity in Plasma.

A. RUKHADZE (General Physics Inst., Moscow, Russia) – Stimulated Radiation of Electron Beams in Plasma.

B.T. TSURUTANI (California Inst. of Technology, Pasadena, CA, USA) – Wave-Particle Interaction.

A. HASEGAWA (Osaka Univ., Japan) – New Ideas in Magnetic Confinement.

B.T. TSURUTANI (California Inst. of Technology, Pasadena, CA, USA) – Non-Linear LF Waves.

A. HASEGAWA (Osaka Univ., Japan) – Coherent Structures in Plasmas.

T. SATO (Nat. Inst. for Fusion Studies, Nagoya, Japan) – Complexity in Plasma (2 lectures).

A. THYAGARAJA (Culham Lab., Abingdon, UK) – Modelling Plasma Turbulence: How to Generate Coherence from Chaos.

Y.Z. ZHANG (Univ. of Texas at Austin, USA) – The Renormalization Theory of Plasma Turbulence and its Numerical Testing (2 lectures).

A. THYAGARAJA (Culham Lab., Abingdon, UK) – Modelling Plasma Turbulence: General Notions.

Z. YOSHIDA (Univ. of Tokyo, Japan) – Convective Derivatives Arising in Plasma Physics and Related Phenomena.

V. KARPMAN (Hebrew Univ. of Jerusalem, Israel) – Envelope Solitons and Self-Focusing in Magnetized Plasmas and Other Gyrotropic Media (2 lectures).

A.M . IGNATOV (General Physics Institute, Moscow, Russia) – Non-Linear Waves in Unstable Loss-Free Plasmas (2 lectures).

A. RUKHADZE (General Physics Inst., Moscow, Russia) – Plasma Microwave Electronics.
R. VARMA (Physical Res. Lab., Ahmedabad, India) – Charged Particle Dynamics in a Magnetic Field (2 lectures).
B. COPPI (Massachusetts Inst. of Technology, Cambridge, MA, USA) – Physics of Igniting Plasmas: Relevant Theoretical Issues.
T. HADA (Kyushu Univ., Fukuoka, Japan) – MHD Structures in the Solar Wind.
K.H. SPATSCHEK (Universität Düsseldorf, Germany) – Foundations of Nonlinear Models.
K.H. SPATSCHEK (Universität Düsseldorf, Germany) – Discussion of some models where only a few nonlinear modes are excited.
T. HADA (Kyushu Univ., Fukuoka, Japan) – Stability of MHD Shock Waves.
HUO YU PING (Inst. of Plasma Physics, Hefei, P.R. China) – The Non-Linear Processes of Tearing Mode in Tokamak (2 lectures).
K.H. SPATSCHEK (Universität Düsseldorf, Germany) – Situations with Many Excited Degrees of Freedom.

C.K. BIRDSALL (Univ. of California at Berkeley, CA, USA) – Computer exercises.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	9	
Asia	36	9
Europe	16	4
North and Central America		4
South America	19	
Total	*80*	*17*
Grand Total	***97***	
Directors and Lecturers	18	
Participants	79	
Countries represented	29	
Person-months	81.37	
Applications received	255	

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Title: INTERNATIONAL TOPICAL WORKSHOP ON PLASMA PHYSICS: COHERENT PROCESSES IN NONLINEAR MEDIA

Dates: 16 - 20 October.

Co-sponsors: European Commission (Brussels, Belgium).

Directors: Professors E. Bingham (Rutherford Appleton Laboratory, Didcot, UK) and P.K. Shukla (Ruhr-Universität-Bochum, Germany).

Programme:
J. DAWSON (Univ. of California at Los Angeles, CA, USA) – Nonlinearity in Plasma: A Personal View.
T. CHANG (Massachusetts Inst. of Technology, MA, USA) – Micro/Mesoscale Phenomena in

Space Plasmas.

D. DUBOIS (Los Alamos Nat. Lab., USA) – Nonlinear Saturation of Parametric Instabilities by Excitation of Langmuir Turbulence: Theory and Experiment.

M. GOLDMAN (Univ. of Colorado, Boulder, CO, USA) – Langmuir Turbulence in Space Plasmas.

H.L. PÉCSELI (Universiteit I Olso, Blindern, Norway) – Nonlinear Wave Interactions in Two-Electron-Temperature Plasmas.

M. NAMBU (Kyushu Univ., Fukuoka, Japan) – Consequences of the Plasma Maser Instability in Magnetized Plasma.

V.D. SHAPIRO (Univ. of California at La Jolla, CA, USA) – Mechanisms of Excitation and Nonlinear Effects Involving Lower-Hybrid Auroral Wave Activity.

J.R. JASPERSE (Phillips Lab., Hanscom, MA, USA) – Effect of Two-Particle Correlations on Plasma Waves.

J.J. RASMUSSEN (Riso Nat. Lab., Roskilde, Denmark) – Self-organization and Coherent Structures in Plasmas, Fluids and Optics.

L. STENFLO (Univ. of Umeå, Sweden) – Theory of Nonlinear Plasma Surface Waves.

H. SCHAMEL (Universität Bayreuth, Germany) – Plasma Transport in the Presence of Self-Generated Phase Space Structures.

D. ANDERSON (Chalmers Univ. of Technology, Gothenburg, Sweden)) – Pulse Propagation Determined by the Nonlinear Schrödinger Equation: A Variational Approach.

V.I. KARPMAN (Hebrew Univ. of Jerusalem, Israel) – Stabilization of Collapse in Highly Dispersive Systems.

R.A. CAIRNS (Univ. of St. Andrews, UK) – Nonlinear Structures in Plasmas with Non-Thermal Electrons.

D. RESENDES (Univ. Técnica, Lisbon, Portugal) – Multiple Scattering of Electromagnetic Waves from Distributions of Vortices.

H. KIKUCHI (Nihon Univ., Tokyo, Japan) – Electron Hydrodynamic Vortices in Helical Turbulence.

F. VERHEEST (State Univ. of Ghent, Belgium) – Coherent Nonlinear Processes in Dusty Plasmas.

A. SEN (Inst. for Plasma Research, Gandhinagar, India) – A Model for the Fine Structure of Saturn's Ring.

K. SAUER (Max-Planck-Institut für Extraterrestrische Physik, Berlin, Germany) – Bi-ion Magnetoacoustic Pulsations During Weak Solar Wind Massloading.

R.K. VARMA (Phys. Res. Lab., Ahmedabad, India) – Global Density and Magnetic Field Structures in Spiral Galaxies: The Spiral Arms and the Bi-symmetric Magnetic Fields.

N.L. TSINTSADZE (Georgia Cade. of Sciences, Tbilisi, Georgia) – Relativistic Electromagnetic Hydrodynamics in a Magnetoactive Plasma.

G. MATTHIEUSSENT (Univ. de Paris Sud, Orsay, France) – Electron Acceleration in Nd-Laser Plasma Beat-Wave Experiments.

J.T. MENDONÇA (Univ. Técnica, Lisbon, Portugal) – Theoretical Models for Particle Acceleration in Plasmas.

P. MORA (Ecole Polytechnique, Palaiseau, France) – Particle and Wave Dynamics in the Wake of an Ultra-Intense Self-Focused Laser Pulse.

M. LONTANO (Ist. di fisica del plasma, Milan, Italy) – Super-Intense Laser Pulse Dynamics in Collisionless Plasmas.

V.P. SILIN (P.N. Lebedev Inst. of Physics, Moscow, Russia) – Theory of Nonlocal Transport in Laser Produced Plasmas.

D. PESME (Ecole Polytechnique, Palaiseau, France) – Numerical Simulations of Filamentation and its Interplay with SBS in Underdense Plasmas.

H.C. PANT (Centre for Advanced Technology, Indore, India) – Coherent Structures in Ablatively Compressed Solid Targets.

R. FEDELE ("Federico II" Univ. of Naples, Italy) – A Wave Theory for the Negative Mass

Instability.
R.O. DENDY (UK Atomic Energy Authority, Abingdon, UK) – Ion Cyclotron Emission due to Collective Alpha-Particle Instability in JET and TFTR.
K. RYPDAL (Univ. of Tromsø, Norway) – Coherent Structures in the Turbulent Equilibrium of the Simple Magnetized Torus.
J. NYCANDER (Uppsala Univ., Sweden) – Turbulent Equipartition and Up-Gradient Fluxes.
R. POZZOLI (Univ. of Milan, Italy) – Dynamics of Magnetic Perturbations in the Presence of an X Point.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	4	
Asia	15	5
Europe	12	31
North and Central America		4
South America	6	
Total	*37*	*40*
Grand Total	***77***	
Directors and Lecturers	39	
Participants	38	
Countries represented	31	
Person-months	16.19	
Applications received	91	

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Title: ADRIATICO RESEARCH CONFERENCE ON TRENDS IN COLLIDER SPIN PHYSICS

Dates: 5 - 8 December.

Co-sponsors: European Commission (Brussels, Belgium), International School for Advanced Studies (SISSA, Trieste, Italy), and Italian National Institute of Nuclear Physics (INFN).

Directors: Professors Y. Onel (University of Iowa, USA), N. Paver (University of Trieste and INFN), and A. Penzo (INFN, Trieste).

Purpose: To cover theoretical, experimental and technological aspects of high energy spin physics, to be investigated either at fixed target experiments or at future collider machines.

Programme:
R.L. JAFFE (Massachusetts Institute of Technology, Cambridge, MA, USA) – The Context of High Energy QCD Spin Physics.
A.D. KRISCH (University of Michigan, Ann Arbor, USA) – SPIN Collaboration and Polarized Proton Beams.
M.J. TANNENBAUM (Brookhaven National Laboratory, Upton, USA) – Spin Physics at RHIC.
S.M. BILENKY (Joint Institute for Nuclear Research, Dubna, Russia) – Neutrino-Proton Elastic Scattering.
N.H. BUTTIMORE (Trinity College, Dublin, Ireland) – Elastic Scattering and the Magnetism of Swift Protons.

A. EFREMOV (Joint Institute for Nuclear Research, Dubna, Russia) – The Jet Handedness. Introduction and Results.

A. DOROKHOV (Joint Institute for Nuclear Research, Dubna, Russia) – Instanton Induced Spin Effects in Exclusive Hadronic Form Factors.

Z.L. LIANG (Freie Universität, Berlin, Germany) – Single-Spin Asymmetries in High Energy Inclusive Hadron-Hadron Collision Processes.

M. CHAVLEISHVILI (Joint Institute for Nuclear Research, Dubna, Russia) – Asymmetry Parameters for High Energy Reactions.

J. LICHTENSTADT (Tel-Aviv University, Israel) – Status of Spin Structure Functions from the SMC Experiment and Considerations on a High Energy Polarized e-p Collider Experiment at HERA.

S. FORTE (CERN, European Organization for Nuclear Research, Geneva, Switzerland) – Polarized Structure Functions in Deep-Inelastic Scattering.

J. BLÜMLEIN (DESY, Deutsches Elektronen-Synchrotron, Zeuthen, Germany) – Aspects of Structure Function Measurements at HERA in the Polarized Collider Mode.

J. JOHNSON (University of Wisconsin, Madison, USA) – SLD Physics with Polarized Beams.

C. VERZEGNASSI (University of Lecce, Italy) – Spin Physics at e+e- Colliders.

A.A. PANKOV (Gomel Polytechnical Institute, Gomel, Belarus) – Probing Trilinear Gauge Boson Couplings at e+e- Colliders with Polarized Beams.

A. LIKHODED (Branch of the Institute of Nuclear Physics, Protvino, Russia) – Anomalous Boson Couplings for a Strongly-Interacting Electroweak Symmetry Breaking Sector at NLC.

D.P. BARBER (DESY, Deutsches Elektronen-Synchrotron, Hamburg, Germany) – Longitudinal Electron Polarization at HERA and Prospects for Proton Polarization at Very High Energy.

L. PIEMONTESE (INFN, Istituto Nazionale di Fisica Nucleare, Ferrara, Italy) – Spin Transport and Polarimetry at SCC/SLD.

M. PLACIDI (CERN, European Organization for Nuclear Research, Geneva, Switzerland) – Five Years of Transverse Polarization at LEP.

T. ROSER (Brookhaven National Laboratory, Upton, USA) – Acceleration and Storage of Polarized Proton Beams.

A. YOKOSAWA (Argonne National Laboratory, USA) – Collider Spin Physics at RHIC and STAR.

N. SAITO (RIKEN, Institute for Physical and Chemical Research, Saitama, Japan) – Spin Structure of the Nucleon and Further Perspectives of Spin Physics from PHENIX.

W.D. NOWAK (DESY, Deutsches Elektronen-Synchrotron, Zeuthen, Germany) – Prospects for Nucleon Nucleon Spin Physics at HERA.

E. DI SALVO (INFN, Istituto Nazionale di Fisica Nucleare, Genova, Italy) – Gottfried and Bjorken Integrals and Gluon Polarization in the Proton.

S. GOLOSKOKOV (Joint Institute for Nuclear Research, Dubna, Russia) – Spin Asymmetries in Diffractive High Energy Reactions.

M. ANSELMINO (University of Turin, Italy) – Single Spin Asymmetries in Inclusive Hadron Production.

M. CONTE (INFN, Istituto Nazionale di Fisica Nucleare, Genova, Italy) – Evolution of the Spin-Splitter Concept.

N. AKCHURIN (University of Iowa, Iowa City, USA) – Review on Polarimeters.

D. BASSI (INFN, Istituto Nazionale di Fisica Nucleare, Trieste, Italy) – New Ideas on Polarized Atomic Hydrogen Sources.

J. FELIX-VALDEZ (Universidad de Guanajuato, Mexico) – Lambda-Antilambda Polarization in pp-$\geq$ Lambda Antilambda x at 27.5 GeV.

N. GHAHRAMANY (Shiraz University, Iran) – Transversity Amplitude in Kaon-Proton Elastic Scattering.

A. LUCCIO (Brookhaven National Laboratory, Upton, USA) – Tracking Through Spin Resonances in the AGS and RHIC and the Design of Siberian Snakes and Spin Rotators for RHIC.

A. BRAVAR (INFN, Istituto Nazionale di Fisica Nucleare, Trieste, Italy) – Results from E-704 on Inclusive Processes.

P.H. HANSEN (Niels Bohr Institute, Copenhagen, Denmark) – Lambda Polarization from Z Decay at ALEPH.

S. NURUSHEV (Institute for High Energy Physics, Protvino, Russia) – Summary of Experimental Data on High Energy Spin Physics.

J. SOFFER (CNRS, Centre de Physique Théorique, Marseille, France) – Survey of Spin Theory.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	1	
Asia	3	2
Europe	8	29
North and Central America	1	9
International Organizations		6
Total	*13*	*46*
Grand Total	***59***	
Directors and Lecturers	35	
Participants	24	
Countries represented	17	
Int'l Organizations represented	2	
Person-months	10.48	
Applications received	67	

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MATHEMATICS

Title: RESEARCH IN MATHEMATICS

Dates: Throughout the year.

Organizer: Professor M.S. Narasimhan (ICTP).

Purpose: To enhance the research capabilities of mathematicians mainly from developing countries, through the Post-Doctoral, Visiting, Associateship and Federated Institutes programmes, providing opportunities for contact with high-level mathematicians throughout the year.

In 1995, the emphasis was on partial differential equations.

The preprints produced (see relevant section) were subsequently published in important journals of international repute.

Seminars:

M. MAHDAVI-HEZAVEHI (Sharif Univ. of Technology, Tehran, Iran) – On the Tannaka-Artin problem.

M. PRIMIC (University of Zagreb, Croatia) – Annihilating fields and combinatorial identities.

A. AMBROSETTI (Scuola Normale Superiore, Pisa, Italy) – Calculus of variations and nonlinear problems.

G. OMEL'YANOV (Moscow State Inst. of Electronics and Maths., Russia) – Nonlinear evolution of fluctuations in the tokamak plasma and dynamics of the plasma pinch boundary.

G. BESSA (Univ. Federal do Ceará, Fortaleza, Brazil) – Tangent cones at infinity under quadratic sectional curvature decay.

P. HAJLASZ (Institute of Mathematics, Warsaw University, Poland) – Sobolev mappings, calculus of variations and algebraic topology.

C. KALISA (Rwanda, and Université Catholique de Louvain, Belgium) – Coherent states for geometric optics.

V. BRINZANESCU (Romanian Academy, Bucharest) – Appell-Humbert theorem for families of tori.

NGUYEN MINH TRI (Hanoi Institute of Mathematics, Vietnam) – Sobolev imbedding theorems for degenerate metrics.

Y. MIYAOKA (Res. Inst. for Mathematical Sciences, RIMS, Kyoto University, Japan) – Towards bounding of curves of a given genus on a surface of general type.

G.A. OMEL'YANOV (Moscow State Institute of Electronics and Mathematics, Russia) – Free boundary problem, I: Phase field system and modified Stefan problem.

P.G. GEORGIEV (University of Sofia, Bulgaria) – Submonotone mappings in Banach spaces and applications.

G.A. OMEL'YANOV (Moscow State Institute of Electronics and Mathematics, Russia) – Free boundary problem, II: The non-isothermal Cahn-Hilliard model.

YOUDE WANG (Institute of Mathematics, Academia Sinica, Beijing, P.R. China) – Ferromagnetic spin chain equation and its geometric generalisation.

A. SUSLIN (Northwestern University, Evanston, Ill., USA, and Steklov Mathematical Institute, St. Petersburg, Russia) – Cohomology of infinitesimal algebraic groups.

A.H. SIDDIQUI (Aligarh Muslim University, India) – Fixed point theorems and fractal image compression.

K. VARADARAJAN (University of Calgary, Canada) – Hopfian and Co-Hopfian objects.

A. GARBA (ICTP) – On the pseudospectral Chebychev approximation of the generalized Stokes problem.

C. KALISA (ICTP/Rwanda) – Euclidean coherent states II: Helmholtz optics.

M. DATTA (ICTP/India) – Partial differential relations and h-principle.
L.U. UKO (University of Ibadan, Nigeria/ICTP) – The generalized Newton's method and its applications.
A.S. MISHCHENKO (Moscow State University, Russia) – Analytic torsion over C^*-algebras.
P. HAJAC (University of Warsaw, Poland) – Hopf-Galois extensions and connections in non-commutative geometry.
M. CIPU (Romanian Academy of Sciences, Bucharest) – Replicable functions: a computational approach.
C. WALTER (Université de Nice, France) – Local models for variation of GIT quotients.
C.S. SESHADRI (SPIC Science Foundation, Madras, India) – Degeneration of moduli spaces of vector bundles.
A. VERRA (III Universita' di Roma, Italy) – On the generalized theta divisor of the moduli space of rank 2 vector bundles over a curve.
V. LAKSHMIBAI (Northeastern University, Boston, MA, USA) – Degeneration of flag varieties to toric varieties.
V. MATHAI (University of Adelaide, South Australia) – Determinant lines and L^2-torsion.
C.S. SESHADRI (SPIC Science Foundation, Madras, India) – Deformations in algebraic geometry.
L. MAKAR-LIMANOV (Tel Aviv, Israel) – Threefolds which look like C^3 but are not C^3 (in connection with the linearization conjecture).
A.R. SHASTRI (Indian Institute of Technology, Bombay, India) – Rationality of homology planes.
J. KAUTA (University of Malawi) – Non-commutative valuation theory and its applications.
C. PEDRINI (Università di Genova, Italy) – Zero cycles and mixed Hodge structures on singular complex surfaces.
G.P. BESSA (Universidade Federal do Ceará, Brazil, and ICTP) – On Hadamard's conjecture.
V.K. KATIYAR (University of Nigeria, Nsukka) – Mathematical models in biology and medicine.
M. BOZICEVIC (Geotechnical Faculty, Varazdin, Croatia, and ICTP) – Weyl group actions on Lagrangian cycles.
F. TORRES (ICTP) – The genus of curves over finite fields with many rational points.
P. GEORGIEV (University of Sofia, Bulgaria) – Min-max variational principles and applications to the critical point theory and Ky-Fan inequalities.
G.O.S. EKHAGUERE (University of Ibadan, Nigeria/ICTP) – Quantum stochastic evolutions.
I. RAMADHANI (University of Kinshasa, Zaire) – Nonstandard finite difference schemes and numerical instabilities.
SIYE WU (ICTP/P.R. China) – Non-Abelian equivariant holomorphic morse inequalities.
G.O.S. EKHAGUERE (Univ. of Ibadan, Nigeria, and ICTP) – Quantum stochastic evolutions.
I. RAMADHANI (Univ. of Kinshasa, Zaire) – Nonstandard finite difference schemes and numrical instabilities.
SHENGLI TAN (ICTP and East China Normal University, Shanghai, P.R. China) – Rank two vector bundles on algebraic varieties.

Joint ICTP/SISSA Semester in geometry and mathematical physics:
A. SHLAPUNOV (Scuola Normale Superiore, Pisa, Italy) – Criterions for the validity of the Poincaré Lemma for elliptic differential complexes. On the ill-posed Cauchy Problem for elliptic systems.

Informal Seminars:
A.S. MISHCHENKO (Moscow State Univ., Russia) and Noor MOHAMMAD (Quaid-i-Azam Univ., Islamabad, Pakistan) – Banach algebras: theory and applications.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	28	
Asia	56	2
Europe	15	13
Indonesia and Oceania		1
North and Central America	1	7
South America	7	
International Organizations		1
Total	*107*	*24*
Grand Total	***131***	
Countries represented	55	
Int'l Organizations represented	1	
Person-months	335.68	
Applications received	283	

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Title: CONFERENCE ON TOPOLOGICAL AND GEOMETRICAL PROBLEMS RELATED TO QUANTUM FIELD THEORY

Dates: 13 - 24 March.

Co-sponsors: European Commission (Brussels, Belgium).

Directors: Professors P.J. Braam (University of Oxford, UK), C. De Concini (Scuola Normale Superiore, Pisa, Italy), and R. Dijkgraaf (University of Amsterdam, The Netherlands), M.S. Narasimhan (ICTP).

Purposes: To bring together mathematicians whose work relates to quantum field theory; to convey recent results through talks; to offer introductions to the area through mini-courses; to provide a forum for discussion.

Report:

Objectives — The Conference was organized for an audience of experts and young mathematicians from developing countries, working in the area of geometry and topology where this relates to developments in theoretical physics.

We selected four topics for our Conference: mirror symmetry, quantum gravity, Floer homology and the theory of Seiberg-Witten monopoles. These fields have a common origin in theoretical physics but recent progress in both mathematics and theoretical physics has shown them to be inextricably related.

The areas are considered difficult to learn, and it was thought that a meeting would be particularly profitable if it consisted of experts and mathematicians from Third World countries, and if suitable mini-courses were presented that would serve as introductions to the area.

Structure and organization:

1. Four mini-courses;
2. Four problem sessions;
3. Seventeen lectures;
4. Five parallel sessions.

Participation — The total number of registered participants was 62; however, the lectures were attended by many more mathematicians and physicists present at the ICTP for other activities. Several young European mathematicians also participated and were financially

supported by the Euroconference Programme of the European Commission.

Scientific Content — The four mini-courses covered the areas of perturbation theory in gauge theories (Axelrod), Seiberg-Witten monopoles (Braam), mirror manifolds (Candelas) and duality in field theories (Dijkgraaf). All of these presented very recent results in an attractive way. The most recent results were presented in the following areas:

- Mirror symmetry (lower dimensional examples, K3 surfaces);
- Symplectic Floer homology (isotopy of symplectomorphisms);
- Seiberg-Witten invariants (constraints on embedded surfaces, relations with duality);
- Magnetic monopoles (relations with rational maps);
- Moduli space of vector bundles over curves (computations of the cohomology ring).

P.J. Braam, C. De Concini, R. Dijkgraaf

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia	10	2
Europe	10	23
Indonesia and Oceania	1	
North and Central America	1	9
South America	4	
Total	*28*	*34*
Grand Total	***62***	
Directors and Lecturers	17	
Participants	45	
Countries represented	23	
Person-months	26.08	
Applications received	123	

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Title: WORKSHOP ON DYNAMICAL SYSTEMS

Dates: 22 May - 2 June.

Co-sponsors: Instituto de Matemática Pura e Aplicada (IMPA, Rio de Janeiro, Brazil) and European Commission (Brussels, Belgium).

Directors: Professors J. Palis (IMPA, Rio de Janeiro, Brazil), Ya. Sinai (Princeton University, USA) and J.C. Yoccoz (Université de Paris XI, Orsay, France).

Report: The Workshop was intended for young mathematicians in developing countries working in the general area of Dynamical Systems.

Structure and Organization — Altogether, forty-one lectures of 45 minutes each, followed by 10-minute discussions, and twenty-eight 30-minute talks were delivered.

Scientific Content — The topics covered were:

- Bifurcations, chaotic systems, strange attractors, invariant measures;
- Variational methods in Hamiltonian and Lagrangian systems;
- Polynomial differential equations, Stoke's phenomenon and Hilbert's problems;
- One-dimensional dynamics.

Many new results of high scientific quality were reported at the Workshop, especially from young researchers working in developing countries. The interaction was intense and I heard of

many plans from participants to have joint research projects.

The overall activity was exceptionally high-standard; nothing less could be expected from this team of Directors, one of them being a Field Medalist.

The Directors propose to have another Workshop at ICTP in 1998.

G. Vidossich

Programme:

M. VIANA (IMPA, Rio de Janeiro, Brazil) – Stochastic stability of non uniformly hyperbolic systems.

D. SZASZ (Maths Inst., Ac. of Sciences, Budapest, Hungary) – The Boltzmann-Sinai ergodic hypothesis for hard ball systems.

A. NEISHTADT (Space Research Institute, Moscow, Russia) – On stability loss delay for periodic trajectories in the systems with slowly varying parameters.

R. PEREZ-MARCO (Université de Paris-Sud, Orsay, France) – Hedgehog's dynamics.

V.P. KOSTOV (Université de Nice, France) – Monodromy groups of Fuchsian systems on CP (1) and their invariants.

J.-M. GAMBAUDO (Université de Nice, France) – Infinitely renormalizable diffeomorphisms of the 2-disk.

A. VERJOVSKY (Université de Lille 1, France) – Some examples of non symplectic compact complex manifolds.

M. LYUBICH (SUNY at Stony Brook, USA) – Geometric bounds for complex polynomials.

J. PALIS (IMPA, Rio de Janeiro, Brazil) – A view and recent results on chaotic dynamics.

T. NOWICKI (University of Warsaw, Poland) – Fibonacci unimodal maps: Cantor attractors and beyond.

M.J. PACIFICO (Univ. Federal do Rio de Janeiro, Brazil) – Global spiralling attractors.

S.V. BOLOTIN (Moscow State University, Russia) – Heteroclinic chains for quasiperiodic Hamiltonian systems.

P. DUARTE (Universidade de Lisboa, Portugal) – Persistent homoclinic tangencies in conservative dynamics.

R. MARKARIAN (Universidad de la República, Montevideo, Uruguay) – Smooth hyperbolic repellers of Anosov type. Ergodic properties.

S. NEWHOUSE (Michigan State Univ., East Lansing, USA) – Chaotic attractors in area-decreasing diffeomorphisms.

Y. SINAI (Princeton Univ., and Landau Ins. Theor. Phys., Moscow) – Thermodynamic limit of Lyapunov spectrum.

G. FORNI (Università di Bologna, Italy, and Cambridge Univ., UK) – Homological equation for area preserving vector fields on compact orientable surfaces.

M. JAKOBSON (University of Maryland, College Park) – SRB measures for 2-dimensional maps with unbounded derivatives.

X. GOMEZ-MONT (Centro de Investigación en Matemáticas, CIMAT, Guanajuato, Mexico) – Periodic points in conformal dynamics.

S. YAKOVENKO (Weizmann Ins. of Sc., Rehovot, Israel) – Multidimensional and complex versions of the Rolle theorem with applications to complex zeros of quasipolynomials and Abelian integrals.

A. DOUADY (Université de Paris-Sud, Orsay, France) – Surgery in complex polynomials.

Yu. IL'YASHENKO (Moscow State University, Russia) – Linear and non-linear Riemann-Hilbert problem.

R. ITURRIAGA (Centro de Investigación en Matemáticas, CIMAT, Guanajuato, Mexico) – Average linking numbers.

B. KRAUSKOPF (University of Groningen, Netherlands) – Bifurcation at infinity in a model for 1:4 resonance.

F. DUMORTIER (Limburgs Universitaire Centrum, Belgium) – Generic unfoldings of the cuspidal loop.

G. SWIATEK (Pennsylvania State University, USA) – Hyperbolicity in the quadratic family.

T. GRAMCHEV (Università di Cagliari, Italy) – Normal forms, Nekoroshev estimates and diophantine phenomena for pseudodifferential operators on tori.

E. CATSIGERAS (Universidad de la República, Montevideo, Uruguay) – Homoclinic tangencies near cascades of period doubling bifurcations.

J.C. YOCCOZ (Université de Paris-Sud, Orsay, France) – Sums of regular Cantor sets.

W. de MELO (IMPA, Rio de Janeiro, Brazil) – Rigidity of critical circle mappings.

H. HANSSMANN (University of Groningen, The Netherlands) – Invariant 2-tori in the motion of a rigid body.

M.J. DIAS CARNEIRO (Univ. Federal de Minas Gerais, Brazil) – Minimizing measures for the action of autonomous Lagrangians.

T. IVANOVA (JINR, Dubna, Russia) – Some integrable dynamical systems as symmetry reductions of the self-dual Yang-Mills equations.

C.G. TAMM DE ARAUJO MOREIRA (IMPA, Rio de Janeiro) – More on sums of regular Cantor sets.

S. PLAZA (Universidad de Santiago de Chile) – Differentiable structures on central Cantor sets.

H. BRUIN (Universität Erlangen-Nürnberg, Germany) – Topological conditions for the (non) existence of absorbing Cantor sets.

K. KHANIN (Landau Ins., Moscow, and Princeton Univ., USA) – Self-avoiding walks: how to fight factorial divergence.

L. DIAZ (P.U.C., Rio de Janeiro, Brazil) – Persistence of partially hyperbolic transitive attractors.

E. PUJALS (IMPA, Rio de Janeiro, Brazil) – Singular attractors and saddle node singular cycles.

A. GLUTSUK (Moscow State University, Russia) – Global stability conjecture: 2-dimensional proof and 3-dimension counterexample.

H. ENRICH (Universidad de La República, Montevideo, Uruguay) – A heteroclinic bifurcation of Anosov diffeomorphisms.

S. MARMI (Università di Firenze, Italy) – Some properties of the Brjuno function.

S. LUZZATTO (Université de Paris VI, France) – Lorenz-like attractors without invariant foliations.

N. SHAH (T.I.F.R., Bombay, India) – Unipotent flows and limit distributions of polynomial trajectories on homogeneous spaces.

L.F. DA ROCHA (Univ. Fed. do Rio Grande do Sul, Brazil) – Continued fraction algorithms for interval exchange maps.

F. PRZYTYCKI (Polish Academy of Sciences, Warsaw) – Holomorphic Collet-Eckmann maps.

L. MORA (Inst. Venezolano de Investigaciones Científicas, IVIC, Caracas, Venezuela) – Homoclinic bifurcations for endomorphisms.

S. ABENDA (Università di Bologna, Italy) – Complex time singularities for polynomial Hamiltonians analytic in time via Painlevé's alpha-method.

M.V. FOKIN (Academy of Sciences, Novosibirsk, Russia) – Hamiltonian systems with continuous spectrum and chaotic oscillations of rotating fluid.

C.A. MORALES (IMPA, Rio de Janeiro, Brazil) – Degenerate singular cycles of inclination-flip type.

J.S.W. LAMB (University of Warwick, Coventry, UK) – Resonant driving and k-symmetry.

T.Z. NGUYEN (SISSA, Trieste, Italy) – Singularities of integrable systems and applications to. KAM-theory.

M.A. TEIXEIRA (UNICAMP, Campinas, Brazil) – Bifurcation of singularities of reversible vector fields.

J. MATHER (Princeton University, USA) – Connecting orbits and Lagrangian systems.

S. HAYASHI (Waseda University, Tokyo, Japan) – Connecting invariant manifolds and the stability and Ω-stability conjectures for flows.
R. URES (Universidad de la República, Montevideo, Uruguay) – On the approximation of SBR-measures by Dirac measures supported on sinks in the Hénon family.
Yu. L. MAISTRENKO (Ac. Sc., Kiev, Ukraine) – Bifurcations in piece-wise families.
R. LABARCA (Universidad de Santiago de Chile) – Three-dimensional singular cycles.
A.A. DAVYDOV (Vladimir State Technical University, Russia) – Normal forms of folded elementary singular points of implicit ODE's and complete classification of linear second order PDE's on the plane.
B. KHANEDANI (Inst. for Studies in Theor. Phys & Maths., IPM, Tehran, Iran) – First variations of 1-forms and some applications.
M. RABII (Sharif University of Technology, Tehran, Iran) – Some results on the dynamics of $Z^m(Z^n - b)$.
M.E. POPESCU (Romanian Acad. of Sciences, Bucharest) – Stability on periodical orbit class.
L.P. SHILNIKOV (Ins. Appl. Maths, Nizhni Novgorod, Russia) – Blue sky catastrophes and hyperbolic attractors.
A. ROVELLA (Univ. de la República, Montevideo, Uruguay) – Convex delay endomorphisms.
R. ROUSSARIE (Université de Bourgogne, Dijon, France) – A Poincaré-Bendixson theorem for analytic families of vector fields.
R. MacKAY (University of Warwick, Coventry, UK) – Self-localized vibrations in networks of oscillators.

Colloquium: J. PALIS (IMPA, Rio de Janeiro, Brazil) – Past and present in chaotic dynamics.

Participants' talks.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	9	
Asia	19	2
Europe	34	56
North and Central America	3	8
South America	27	
Total	*92*	*66*
Grand Total	***158***	
Directors and Lecturers	48	
Participants	110	
Countries represented	44	
Person-months	68.73	
Applications received	392	

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Title: CONFERENCE ON PARTIAL DIFFERENTIAL EQUATIONS AND APPLICATIONS TO GEOMETRY

Dates: 21 August - 1 September

Co-sponsor: European Commission (Brussels, Belgium)

Directors: Professors Chang Kung Ching (Peking University, Beijing, P R China) and M Giaquinta (University of Florence, Italy)

Purpose: To present recent progress in the calculus of variations and in the theory of partial differential equations, with special emphasis on applications to geometry, by means of a few short courses and lectures by specialists

Report: The Conference was organized for an audience of young mathematicians from developing countries Our aim was to bring them in contact with the recently flourishing use of analytic, and especially PDE methods in geometrical problems

There were seventeen speakers. three of them gave series of lectures of more than four hours, five of them a series of three lectures, five of them two lectures, finally, four of them gave a one-hour lecture each Moreover, seven young participants presented their research work in a seminar session

The speakers gradually introduced and illustrated some of the most recent results and problems, for instance, in the following topics Variational problems in quantum field theory, Dirac operator in relativistic mechanics, Ginzburg-Landau vortices, Kahler-Einstein metrics, curvature problems, harmonic and p-harmonic maps

Our impression, deriving from discussions with the speakers and the participants, is that the Conference has been quite successful, not only did the experts enjoy it, but also the participants gained more knowledge and learned new methods

Chang Kung Ching, M Giaquinta

Programme:

A ADIMURTHI (TIFR, Bangalore Centre, India) – Role of the mean curvature in semilinear Neumann problems (3 lectures)

G ANZELLOTTI (Universita di Trento, Povo, Italy) – Generalized curvatures and variational problems (2 lectures)

T AUBIN (Universite Paris VI, France) – The best constant in the Sobolev inequality is achieved

A BAHRI (Rutgers University, New Brunswick, USA) – Scalar curvature equations (4 lectures)

V BENCI (Universita di Pisa, Italy) – Some recent applications of Morse theory (3 lectures)

H BREZIS (Université Pierre et Marie Curie, Paris, France) – Ginzburg-Landau vortices (3 lectures)

M J ESTEBAN (Universite Paris-Dauphine, Paris, France) – Variational models in relativistic mechanics (2 lectures)

R M HARDT (Rice University, Houston, USA) – P-harmonic maps and related variational problems (3 lectures)

T H ILMANEN (University of Wisconsin, Madison, USA) – Some techniques in geometric heat flow (4 lectures)

J JOST (Ruhr-Universitat Bochum, Germany) – Variational problems from geometry and quantum field theory (5 lectures)

E KUWERT (Universitat Bonn Germany) – Minimization of conformally invariant energies in homotopy classes (3 lectures)

L LEMAIRE (Universite Libre de Bruxelles, Belgium) – The space of harmonic maps from S^2 to CP^2

LIU Jia Quan (Peking University, P R China) – Prescribing scalar curvature problems

TIAN Gang (Courant Institute of Mathematical Science, New York, USA) – Einstein metric with positive scalar curvature (2 lectures)

L. VERON (Université François Rabelais, Tours, France) – Quasilinear elliptic equations on Riemannian manifolds (2 lectures).
WANG Zhi-Qiang (Utah State University, Logan, USA) – Some minimization problems with symmetry related to a nonlinear Newmann problem.
YE Rugang (University of California, Santa Barbara, USA) – Holomorphic curves in symplectic geometry (2 lectures).

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	23	
Asia	35	1
Europe	7	42
North and Central America	2	8
South America	10	
International Organizations		1
Total	*77*	*52*
Grand Total	***129***	
Directors and Lecturers	21	
Participants	108	
Countries represented	38	
Int'l Organizations represented	1	
Person-months	64.53	
Applications received	258	

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Title: WORKSHOP ON GENERAL THEORY OF PARTIAL DIFFERENTIAL EQUATIONS AND MICROLOCAL ANALYSIS

Dates: 4 - 15 September.

Co-sponsor: European Commission (Brussels, Belgium).

Directors: Professors Qi Min-you (Wuhan University, P.R. China) and L. Rodino (University of Turin, Italy).

Report:
Objectives — The Workshop was devoted to the recent progress obtained in the field of Partial Differential Equations (PDE) by means of microlocal methods. Addressing an audience of experts and young mathematicians from developing countries, the Directors selected the following topics, which are representative of the new exciting contributions in this area:
- Foundations of microlocal analysis: classical pseudodifferential operators, applications to the Cauchy problem.
- Nonlinear microlocal analysis: Littlewood Paley theory, paradifferential operators, applications to problems of physical nature.
- Analytic-Gevrey theory of PDE: microlocal Gevrey analysis, analytic hyperbolicity.

Structure and organization — (1) 9 expository mini-courses of 3 or 4 hours; (2) 9 one-hour talks by invited speakers; (3) 2 parallel seminars, taking place in the afternoons, where young mathematicians presented their own work.
Participation — The response from the mathematical community for the Workshop was very

enthusiastic. There were invited speakers from all over the world, and a large number of well-known experts and young mathematicians contributed significantly to the Workshop. The meeting was also attended by several young European mathematicians, sponsored by the European Commission's Euroconference Programme.

Scientific content — The mini-courses and the one-hour talks presented the most recent results in the following main topics:

- General theory of PDE on distributions and ultradistributions. Linear equations with multiple characteristics in Gevrey classes.
- Pseudodifferential operators and wave front sets. Cauchy problem for linear hyperbolic equations.
- Analytic hyperbolic equations and systems.
- Littlewood-Paley theory, paradifferential operators. Propagation of singularities and hypoelliptic non-linear equations.
- Microlocal methods for non-linear wave equations, oscillation and concentration effects.
- Second wave front set; applications to non-linear hyperbolic equations.

One of the two seminars was on Microlocal Analysis, addressed to specialists in the topics of the Workshop, the other on PDE and Applications, addressed to non-specialists, working in related areas.

Qi Min-you, L. Rodino

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	18	
Asia	32	3
Europe	8	29
North and Central America	1	
South America	4	
International Organizations		1
Total	*63*	*33*
Grand Total	***96***	
Directors and Lecturers	17	
Participants	79	
Countries represented	32	
Int'l Organizations represented	1	
Person-months	51.7	
Applications received	181	

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PHYSICS AND ENERGY

Title: WORKSHOP ON MATERIALS SCIENCE AND PHYSICS OF NON-CONVENTIONAL ENERGY SOURCES

Dates: 18 September - 6 October.

Directors: Professors G. Furlan (University of Trieste and ICTP), C.G. Granqvist (Chalmers University of Technology, Gothenburg, and Uppsala University, Sweden), D. Nobili (Istituto di chimica e tecnologia dei materiali e dei componenti per l'elettronica, LAMEL-CNR, Bologna, Italy), and A.M. Sayigh (World Renewable Energy Network Secretariat, Reading, UK).

Purpose: To discuss those aspects of materials science and technology which are particularly relevant to solar energy conversion and storage.

Report:

1. The activity on Non-Conventional Energy Sources started at the ICTP in 1977 with a workshop regularly repeated every two years, (until 1986 it was alternated with an analogous course in French). Since its first edition, the Workshop has represented one of the most lively and requested short-term activities offered by the ICTP, as testified by the large number of applications received and by its worldwide reputation. This is of course related to the importance ascribed to the subject by many developing countries (India has a special Ministry for Renewable Energies!). Recently the crucial role that those sources of energy might play for sustainable development has been re-emphasized by several international initiatives from the Rio Conference to the UNESCO proposal for a Solar Decade (1995-2005). Given its unique position and prestige in the UN family, the ICTP can act as a first rank member in those projects and we should try to keep our institution visible, responding with special attention to the requests for collaboration and scientific advice coming from the Third World. In this connection, the special programmes of the ICTP like the TRIL (Training and Research in Italian Laboratories) and OEA (External Activities), and of the TWAS (Third World Academy of Sciences), could be particularly useful.

2. 139 participants from 52 countries attended the Workshop (applications: 315): due to the reduced budget, the number of regular participants selected was quite lower than usual (about 50) and a good fraction of the audience was represented by the Associates, Affiliates and ICTP TRIL Fellows. To further confirm the good quality of the audience and the scientific programme, I would like to mention that even the very last session was followed by lively participation and interest. A few travel grants were given by Swedish sources (like the International Science Programmes, IPPS, Uppsala). Most Italian speakers came free-of-cost.

The Workshop consisted of three weeks of plenary lectures, mostly concentrated in the morning. The afternoons were devoted to additional colloquia, to working groups with presentation of papers by the participants and discussions with the lecturers. The running of this part of the activities was mainly the responsibility of the 5 Resident Scientists: their presence has been really fruitful and represents an important element for the future successful development of the activity. They were: H. P. Garg (Center for Energy Studies, IIT, New Delhi, India), S. Ibrahim (Al-Azhar University, Cairo, Egypt), A. Lamagna (Comisión Nacional de Energía Atómica, Buenos Aires, Argentina), S. Pietruszko (Technical University of Warsaw, Poland) and Yin Zhiqiang (Tsinghua University, Beijing, China).

The bulk of the programme was represented by the lectures on Materials for Solar Energy Conversion and in particular on Photovoltaics and its applications. A few colloquia were devoted to the state of the art in Wind Energy, Biomass and Energy Saving in Architecture.

In particular, the first week covered the Materials Science aspects of Solar Energy with emphasis on basic research (the physics/device side) while the second week was mostly devoted to the problems concerning realizations (the engineering/system side). The production of electricity by large plants, grid-connected, received special attention together with some very practical lectures devoted to the monitoring and sizing of the panels.

In the third week, several lectures related to electrochemical conversion were examined

(batteries, fuel cells, storage, etc.). We also did have a series of afternoon computer demonstrations carried out by Dr. E. Negro (France) on P.V. System Simulation. These sessions proved to be very useful to the participants.

A successful element of the Workshop activity was represented by two separate trips (on 29 September) to: 1) HELIOS Technology in Padua, a solar cell factory, 2) MASPEC (Materiali Speciali per l'Elettronica) in Parma, a high-level laboratory of the Italian Research Council (CNR). Both visits were quite successful and highly appreciated by the participants.

3. The Workshop was quite successful, also thanks to the good level and enthusiasm of the lecturers and of the participants. The presentation of papers from the participants was quite lively with good material and some of the communicated papers will be included in the Proceedings. A Poster Session was also organized. Many young and new faces were present (mostly from Albania, Macedonia, Poland, Tunisia and India), bringing added enthusiasm and fresh points of view.

The balanced blending of fundamental and applied aspects represents one of the features characterizing the ICTP Workshop which also reflects on the variegated composition of the audience. This fact favors discussions and comparisons which find an ideal ground at the ICTP. As ever, many discussions were devoted to interregional collaborations and to the need of an increased attention of the ICTP towards outside activities. It is appropriate to mention that two colleagues from the European Physical Society visited during the Workshop in order to discuss the organization of a Workshop on Renewable Energies in Seville in 1996, a satellite event to the main EPS Conference. The ICTP is expected to be among the sponsors.

Conclusion:

- The latest news and perspectives were presented by renowned experts;
- the participants had the possibility of presenting their own work and of discussing problems of common interest, and of comparing different experiences with colleagues of neighbouring and of far away areas;
- outside visits were organized and proved successful.

The ICTP Workshop on Renewable Energies represents an important event for many scientists in developing countries and has a unique role in stimulating collaboration and the transfer of know-how at any level. The possibility of having it discontinued has already lead to general feelings of disappointment.

G. Furlan

Programme:

D. NOBILI (Istituto di chimica e tecnologia dei materiali e dei componenti per l'elettronica, LAMEL-CNR, Bologna, Italy) – Recent Developments in Understanding Si Doping with Phosphorus.

L. KAZMERSKI (Nat. Renewable Energy Lab., Golden, CO, USA) – P.V. Technologies: Background and Industry.

S. DEB (Nat. Renewable Energy Lab., Golden, CO, USA) – NREL Programs on P.V. and other Renewables.

I. PURICA (Regia Autonoma de Electricitate, Bucharest, Romania) – EURIO: Networking Energy Modelling Programmes and Institutions.

C. GRANQVIST (Chalmers University of Technology, Gothenburg, and Uppsala University, Sweden) – Electrochromism and Electrochromic Devices.

L. KAZMERSKI (Nat. Renewable Energy Lab., Golden, CO, USA) – P.V. Technologies: Module and Cell Measurements.

S. DEB (Nat. Renewable Energy Lab., Golden, CO, USA) – Thin Film Solar Cells.

S. IBRAHIM (Al-Azhar Univ., Cairo, Egypt) – A Matrix Method for Non-Conventional Energy Goals.

C. GRANQVIST (Chalmers University of Technology, Gothenburg, and Uppsala University, Sweden) – Angular Selective Window Coatings.

L. KAZMERSKI (Nat. Renewable Energy Lab., Golden, CO, USA) – P.V. Technologies: Silicon through Thin Films.

Y. ZHIQIANG (Tsinghua Univ., Beijing, P.R. China) – Selecting Absorbing Surfaces of Solar Energy.
T. KUKU (Obafemi Awolowo Univ., Ile-Ife, Nigeria) – Ternary Cu_2SnS_3 and $PbSnS_3$ Thin Films as Potential Materials for Solar Energy Conversion.
I. MAYS (Renewable Energy Systems Ltd., Herts., UK) – Wind Energy Technology and Economics.
I. MAYS – Wind Energy Implementation and Issues.
F. FERRAZZA (Eurosolar, Nettuno, Italy) – PV: the Industrial Side in Italy.
L. SARDI (ANIT Impianti Fotovoltaici, Genoa, Italy) – PV Systems and Applications.
R. GALLONI (LAMEL-CNR, Bologna, Italy) – Amorphous Silicon Solar Cell Technology (2 lectures).
F. TREBLE (consulting engineer, UK) – Module Design and Testing.
H.P. GARG (Indian Inst. of Technology, Dew Delhi, India) – Energy Education at a University Level.
A. LAMAGNA (Comisión Nacional de Energía Atómica, Buenos Aires, Argentina) – Crystalline Silicon Solar Cells Development at CNEA (2 lectures).
M. PONS (Lab. Informatique pour la Mécanique et Sciences d'Ingénieur, Orsay, France) – Solar Energy and Advanced Adsorption Systems (2 lectures).
H.P. GARG (Indian Inst. of Technology, New Delhi, India) – PV Solar Technology in India: An Industrial Outlook.
K. VOSS (Fraunhofer Inst. for Solar Energy Systems, Freiburg, Germany) – Self-Sufficient Solar House.
K. VOSS – Advanced Glazing Materials.
S. PIETRUSZKO (Technical Univ., Warsaw, Poland) – Physics of the Metastability Properties in Amorphous Silicon.
F. TREBLE (UK) – Calibration of Reference Devices.
N. PUCKER (Graz Technical University, Austria) – Energy Balances for Energy Systems.
F. TREBLE (UK) – PV System Sizing and Performance of PV Arrays.
E. TERZINI (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Portici, Italy) – The Portici Laboratory.
S. CASTELLO (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Portici, Italy) – The DELPHOS Power Plant.
C. ZUCCARO (Centro di Ricerca Elettrica, Cologno Monzese, Italy) – The Serre Power Plant.
S. KARTHA (Princeton Univ., USA) – Global View of the Energy Predicament.
A.A.M. SAYIGH (World Renewable Energy Network Secretariat, Reading, UK) – Bio-climatic Chart Approach in Several Countries.
E. NEGRO (Energy Consulting Les Perriers, Aix-en-Provence, France) – PV Systems Simulation Techniques: Theory (2 lectures).
S. KARTHA (Princeton Univ., USA) – Fuel Cells.
O. CHEHAB (Flachsglas Solartechnik GmbH, Cologne, Germany) – Flachsglas.
A.A.M. SAYIGH (World Renewable Energy Network Secretariat, Reading, UK) – Vernacular Architecture: Modern Views and Energy Saving.
B. SCROSATI (Università "La Sapienza", Rome, Italy) – Batteries (2 lectures).
A. SONNINO (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Santa Maria di Galeria, Italy) – General Aspects of Bio-mass Production (2 lectures).
V. DUTTA (Ente per le Nuove Tecnologie, l'Energia e l'Ambiente, ENEA, Portici, Italy) – Photovoltaic Lighting Systems.
G. MARTINELLI (Università degli Studi di Ferrara, Italy) – PV: University Laboratories to Industry.

Trips to: MASPEC (Parma), HELIOS (Carmignano di Brenta).
Presentation of LAMEL and Discussion Session.
Computer Sessions.
Presentations by Participants.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	43	
Asia	30	
Europe	31	23
North and Central America	1	3
South America	8	
Total	*113*	*26*
Grand Total	***139***	
Directors and Lecturers	18	
Participants	121	
Countries represented	52	
Person-months	74.36	
Applications received	315	

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PHYSICS OF THE ENVIRONMENT

Title: AERONOMY AND RADIOPROPAGATION LABORATORY

Dates: All year

Head: S M Radicella (Programa Nacional de Radiopropagacion, PRONARP, Buenos Aires, Argentina, and ICTP)

ATMOSPHERIC PHYSICS ACTIVITIES

Atmospheric physics related activities at the APRL partially financed by other institutions covered the following areas a) research activities in ionospheric modelling, ionospheric variability, ionospheric total electron content and atmospheric interactions, c) active participation in the International Reference Ionosphere (IRI) operations, and the regional project Prediction and Retrospective Ionospheric Modelling in Europe (European COST 238, PRIME project) including the organization specialised task force meetings It must be noted that the Laboratory will be involved in the research to be carried out in the new European COST 251 (Improved Quality of Service in Ionospheric Telecommunication System Planning and Operation) Project 1995-1998 An important digisonde ionogram data based has been established during 1995 with the co-operation of the Center for Atmospheric Research of the University of Massachusetts at Lowell, USA

The most prominent result in atmospheric physics research correspond to the electron density profile and electron content model developed in collaboration with the Italian Istituto Nazionale di Geofisica improved at the ICTP and finally adopted by the European COST 238 (PRIME) project (Radicella and Zhang, 1995)

The innovative scheme of bringing together data providers from developing and developed countries and modellers in front of computer terminals and to discuss during informal round-table in Task Force Activities, initiated in 1994, was highly successful The second of such activities was on "F1 Layer and the Shape of the Ne profile below NmF2" and was carried out on 8-12 November, 1995 Sixteen experts from 9 countries plus the Chair and Vice-Chair persons of the IRI International Working Group of URSI and COSPAR participated in the activity A series of specific recommended items were determined for the international community working in the field to take action

A similar task force activity was held on 15-17 May 1995 in the framework of the European COST 238 project Seven experts from Austria, Italy and Russia meet at the Laboratory to define the program for the studies on the topside ionosphere over Europe in the new European COST 251 Project that is the continuation of the COST 238 project The scheme defined here was finally adopted in the new project

Ionospheric modelling

The time-dependent and one-dimension model of the electron and ion densities as a function of height in the ionospheric F region developed previously has been used to study the occurrence and evolution of the intermediate F1 region and the characteristic points below the peak electron density in the ionosphere A visiting scientist from the China was involved in this study and two papers have been completed and will be sent for publication

Experimental profiles of electron density obtained from ionospheric soundings in different location from equatorial to middle latitudes were used to study the shape of the ionosphere below the peak electron density in the ionosphere An ICTP Associate from Nigeria and two visiting scientists from Argentina and the Czech Republic were involved in the study and the results were presented at the IRI Task Force Activity

The model of electron density distribution with height in the ionosphere developed at the Laboratory in collaboration with the Italian Istituto Nazionale di Geofisica in previous years and the IRI model have been used in order to estimate the total electron as part of a thesis to apply for the Doctorate in the University of Instanbul The scientist defended successfully his thesis

Ionospheric Variability

Time series of electron density profiles calculated by inversion of ionograms obtained with

traditional ionograms and also using digisonde techniques from low to middle geomagnetic latitudes, have been used to continue the study of the variability of electron density at fixed heights. Previous results from this group have been confirmed. Two visiting scientists from Argentina and China were involved in these studies. The results were presented at the IRI Task Force Activity.

Lower-Upper Atmosphere Interactions:

The investigation of the possible interactions between the lower atmosphere and the ionosphere have been continued, searching for an effect on this upper region of the atmosphere due to the presence of Mesoscale Convective Complexes (MCC) in the subtropical lower atmosphere in South America. The results has been published as an ICTP Internal Report. The search for evidence of the effect of weather fronts on the ionospheric conditions is being investigated in collaboration with the Institute of Atmospheric Physics of the Czech Academy of Sciences.

Radiopropagation and Telecommunications:

APRL activities in radiocommunication related topics jointly financed with other international organizations like URSI and ITU, covered a wide spectrum including: a) in-house training and capacity building; b) advice and guidance of scientists and engineers in the treatment of radiopropagation problems related to specific radiocommunications needs of their countries; c) organization and support of interregional operations in developing countries; d) in-house research with the production of specialized software; and e) pilot projects of local area networks including radio links. All these activities are related to topics included in the ITU Buenos Aires Action Plan for the Global Development of Telecommunications, 1994-1998.

ITU Collaboration:

As a result of the Memorandum of Understanding signed by the ICTP with the International Telecommunication Union (ITU) and the International Union of Radio Science (URSI), a new type of research and development activity was started in the framework of the Laboratory. An ITU expert has been collaborating with ICTP Associates from Nigeria in specific theoretical and experimental studies related to tropical radiopropagation conditions. The analysis of the data obtained in a campaign of measurements of radio wave field strength from a long distance transmitter in the VHF band of the spectrum organized by ITU in Senegal was finalised and the results published. The Laboratory produced the necessary software for the study.

Pilot Project:

A pilot project is under way with the Obafemi Awolowo University in Ile-Ife, Nigeria to provide its campus with an Academic Computer Network. This work is done as a joint project of this Laboratory and the Scientific Computer Section of ICTP in the framework of the "ICTP Programme of Training and System Development on Networking and Radiocommunications".

As a first step, the University will have an international link to ICTP by IDD dial-up line for e-mail. The ICTP will install a campus backbone connection using a spread-spectrum radio system at 950 MHz and 2 Mbps capacity. The use of such system was the result of a study done at the ICTP with the collaboration of experts from Venezuela and the Philippines. The hardware and software parts of the system that have been implemented at the ICTP will link the Computer Centre with the Physical Science Area and the Engineering and Technology Area of the University. Intra-building LAN will use coaxial cabling.

TRAINING ACTIVITIES:

4th ICTP-URSI-ITU(BDT) College on Radiopropagation: Propagation, Informatics and Radiocommunication System Planning, 30 January - 3 March 1995, followed by the 2nd Workshop on Rural Communications in Developing Countries, 6-10 March 1995.

PAPERS

Radicella, S.M. and Zhang, M-L. (1995), "The improved DGR analytical model of electron density height profile and total electron content in the ionosphere", Annali di Geofisica, vol. 38, No. 1, p. 35.

de Gonzalez M.M. and Radicella, S.M. (1995), "Study of ionospheric variability at fixed heights using data from South America", Adv. Space Res., vol. 15.

Ezquer, R.; Adler N.O.; Radicella, S.M.; de Gonzalez, M.M. and Manzano, J.R. (1995), " IRI and BPM Total electron content predictions for Tucuman", Adv. Space Res., vol. 15.

Zhang S-R.; Zhang M-L.; Radicella, S.M.; Huang, X-Y. and Bilitza, D. (1995), "A comparison of the lower transition height obtained with a theoretical model and with IRI", Adv. Space Res., vol. 15.

Zhang S-R.; Zhang M-L.; Radicella, S.M. and Huang, X-Y. (1995), "Comparative studies of electron density profiles between a theoretical model and IRI", Adv. Space Res., vol. 15.

Manzano, J.R.; Radicella, S.M.; Zossi de Artigas, M.M.; Filippi de Manzano, A.N. and Cosio de Ragone, A.H. (1995), "Troposphere-ionosphere interactions during tropospheric MCC events", ICTP-APRL/95/2 Report.

Postogna, F.; Sarpun, I.H.; Radicella, S.M.; and Hughes, K. A. (1995), "Radiowave propagation measurements in Senegal", ICTP-APRL/95/1 Report.

Adeniyi, J.O. (1995), "Experimental equatorial ionospheric profiles and IRI model", ICTP-APRL/95/3 Report.

Hughes, K.A.; Postogna, F. and Radicella, S.M. (1995), "VHF field strength measurements in Senegal", Electronics Letters, vol. 31, No. 20, p. 1787.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	5	
Asia	2	
Europe	8	7
Indonesia and Oceania		1
North and Central America		2
South America	4	
Total	*19*	*10*
Grand Total	***29***	
Countries represented	16	
Person-months	43.36	
Applications received	27	

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Title: STRUCTURE AND NON-LINEAR DYNAMICS OF THE EARTH

Dates: Throughout the year.

Organizers: Professors V.I. Keilis-Borok (Russian Academy of Sciences, Moscow, Russia) and G.F. Panza (Università degli Studi di Trieste, Italy).

Purposes: (1) to develop a new theoretical and computation base for the understanding, creation of models and prediction of seismicity and seismic risk, through the application of non-linear dynamics to these problems; (2) to mitigate seismic risk, based on the most accurate

possible 3-D modelling of earth structure and earthquake sources, through the study of wave propagation in three-dimensionally heterogeneous, inelastic, and anisotropic media; (3) to transfer the technology developed in our project to scientists of the Third World, and to do this through joint research and development projects which combine basic science with high technology.

Report: The activities under "Structure and Non-Linear Dynamics of the Earth" are divided into two main lines. The first is non-linear dynamics with application to earthquake prediction and to the estimation of seismic risk (Projects 1 and 2).

Project 1 (led by V.I. Keilis-Borok). "Non-Linear Dynamics of Lithosphere Blocks". In this project, the earthquake-generating lithosphere is regarded as a hierarchical, non-linear, dissipative system; and earthquakes are considered as critical transitions in it. Also, in the framework of the project theoretical and numerical models of seismicity are developed as a new base for understanding, monitoring and predicting strong earthquakes.

The research in the field of numerical simulation of block structure dynamics continued with new developments. A seismically active region is modelled as a system of absolutely rigid blocks separated by infinitely thin plane faults. The interaction of the blocks along the fault planes and with the underlying medium is viscous-elastic. The system of blocks moves as a consequence of prescribed motion of the boundary blocks and of the underlying medium. When for some part of a fault plane the stress exceeds a certain strength level a stress-drop (a "failure") occurs, and it can cause a failure in other parts of the fault planes. In the model the failures represent earthquakes. As a result of the numerical simulation a synthetic earthquake catalog is produced.

The study of seismicity with the statistical and phenomenological analysis of the real earthquake catalogs has the disadvantage that the reliable data cover, in general, a time interval of about one hundred years or even less. This time interval is very short, in comparison with the duration of tectonic processes responsible of the seismic activity, therefore the patterns of the earthquakes occurrence identifiable in a real catalog may be only apparent and may not repeat in the future. On the other side the synthetic catalog obtained by numerical modelling of the seismogenetic process may cover a very long time interval that allows us to get more reliable estimation of the parameters of seismic flow.

The block model was used to simulate the seismicity of the Vrancea (Romania) seismoactive region. The numerical experiments give the values of the model parameters which supply a synthetic earthquake catalog with the space distribution of epicenters close to the real distribution of epicenters observed in the Vrancea region, and frequency-magnitude relations (Gutenberg-Richter curves) obtained for the synthetic and real catalogs have some common features. The values of the parameters of the model for which the correspondence between the synthetic and real catalogs is achieved can be useful for the estimation of the velocities of the tectonic movements and of the values of the physical parameters connected with the tectonic processes in the fault zones.

The sequences of earthquakes arising in the model were studied for some structures. It was found that "foreshocks", "main shocks", and "aftershocks" could be detected among earthquakes forming the sequences. The features of aftershocks, foreshocks, and catalogs of main shocks were analysed.

The affect of viscous flows, dehydration, and phase transitions on the stress state within the Vrancea slab with implication for intermediate-depth earthquakes was studied by methods of numerical modelling.

The main results obtained in 1995 are the following:

(a) In the Vrancea region from the simulation of the block-structure dynamics it is possible to generate a synthetic catalog that has features similar to these of the real earthquake catalog. The values of the parameters of the model for which the correspondence between the synthetic and the real catalogs is achieved can be useful for estimation of the velocities of the tectonic movements and of the values of the physical parameters connected with the dynamic processes taking place in the fault zones. If the relevant segment of the synthetic catalog, which approximates the real seismic flow with sufficient accuracy, can be identified, then the part of the synthetic catalog immediately following this segment could be used to predict the future behaviour of the seismicity of the region.

(b) For the considered block structures with increasing complexity the slope of the

Gutenberg-Richter curve for the synthetic catalog obtained by numerical modelling increases while the structure complexity increases.

(c) The procedure for recalculating the inelastic displacements in the model after failure has occurred consists generally of several steps. The number of the steps for one procedure can be several tens. If these steps are distinguished then the number of events in the synthetic catalog increases by more than twice.

(d) The numerical model of Vrancea slab evolution that has been developed has applications to geological structure studies.

The research is being done in collaboration with Visiting Scientists from Romania and Russia. Scientists working on this project are A. Ismail-Zadeh, C. Moldoveanu, G. Panza, M. Popa, A. Soloviev, and I. Vorobieva.

Project 2 (led by V.I. Keilis-Borok). "Development and Testing of Algorithms for Earthquake Prediction". Now this project is focused on the development of a new generation of earthquake prediction algorithms. It includes estimation of the major features of earthquakes flow (i.e. similarity, self-similarity, range in correlation in space and time, limits of predictability), the search for new precursor phenomena, the study of migration of the seismic activity for the Pacific ocean belt, and the development of the software for the time-space analysis of seismicity.

The new methods of seismic risk estimation are based on the basis of the statistical analysis of the parameters of the Gutenberg-Richter law on the frequency-of-occurrences for the seismicity of individual seismoactive regions.

The study of the block structure of the Circum-Pannonian region was continued including the determination of disjunctive knots.

The main results obtained in 1995 are the following:

(a) The variation of the slope of the Gutenberg-Richter curve was analysed as a precursor phenomenon for the seismicity of the Southern California region. It was found that the slope of the curve calculated for the medium magnitude range decreases before a strong earthquake. The slope calculated for the small earthquakes increases before a strong earthquake. The retrospective application of the prediction algorithm formulated on the basis of this phenomenon to Southern California gives the following result: the alarms occupy 11% of the total time considered with 6 of 8 strong earthquakes predicted and one false alarm.

(b) It was shown that there was a migration of the seismic activity along the Pacific Belt during the period of abnormal activation from 1950 to 1965.

(c) The new approach to the parametrization of the Gutenberg-Richter law was developed and applied to the estimation of the seismic risk for Italy.

(d) The preliminary scheme of morphostructural zoning was made at 1:2500000 scale for the Circum-Pannonian region. The closeness of the epicenters of the earthquakes with M > 5.0 to disjunctive knots was shown. The significance of these studies lies on the fact that all the five nuclear power plants operating in the region are located on or near to disjunctive knots.

(e) The stability of the prediction results of the strongest earthquakes in the Vrancea region was also appraised.

(f) The development of the software for analysis of dynamics of seismicity was completed and the user's guide for it was prepared. The study of this software was included in the program of the Third Workshop on Non-Linear Dynamics and Earthquake Prediction held at the ICTP on 6 - 17 November 1995.

(g) Appraisal of creepex has shown that it can be used as a measure (inverse) of seismic coupling.

The research is being done in collaboration with Visiting Scientists from Romania, Russia and Nepal. Scientists working on this project are T. Garianova, A. Gorshkov, A. Kaverina, V. Kondratiev, V. Kossobokov, T. Kronrod, I. Kuznetsov, G. Molchan, C. Moldoveanu, A. Nekrasova, O. Novikova, I. Rotwain, and L. Subedi.

The ***second line*** is Structure of the Earth with application to seismic risk mitigation (Projects 3 and 4).

As a vehicle for carrying out the ICTP mandate to serve science and scientists of developing

countries, G.F. Panza and F. Schwab organized Task Group II-4 "Three-Dimensional Modelling of the Earth's Tectosphere" (3DMET) of the Inter-Union (IUGG-IUGS) Commission on the Lithosphere/International Lithosphere Program. 3DMET is now a very large Group — currently about 200 scientists at 69 local centers in 44 different countries. Except for a few members and centers in developed countries, acting mainly in a support capacity, the membership is entirely based in developing nations.

Project 3 (led by G. F. Panza). "Physical Instability of Megacities (PIOM)".

At the 20th General Assembly of the IUGG (Vienna, 1991), the activities of our Task Group II-4 were expanded when it became an International Lithosphere Program contribution to the International Decade for Natural Disaster Reduction (IDNDR) within the PIOM program of ICSU. In 1994 UNESCO declared its special interest for this ILP contribution, centred at ICTP.

The final purpose of this project is the construction of detailed risk maps for selected urban areas, starting with relative amplification maps based upon spectral ratios and spectral amplification computations.

The general plan includes, at present, the following Megacities: Mexico City, Tijuana, Mexicali, Beijing, Bucharest, Rome and Naples. The initial stage of our IDNDR work requires the collection of all available data concerning the shallow geology, and the construction of cross-sections along which to model the ground motion. This work is by its nature multidisciplinary since information is requested from different disciplines, as seismology, history, archaeology, geology and geophysics, to give engineers reliable building codes. For instance, the realistic modelling of ground motion requires the simultaneous knowledge of the geotechnical, lithological, geophysical parameters and topography of the medium, on one side, and tectonic, historical, palaeosismological, seismotectonic models, on the other, for the best possible definition of the probable seismic source. In addition, the competence in sophisticated computer modelling of wave propagation in heterogeneous anelastic media is required for the best possible exploitation of the existing information on structures and sources. Most of this IDNDR work is centred at ICTP, and following the ICTP mandate, is carried for third-world Megacities, by task-group scientists from the associated countries.

In particular, the project of the microzonation of Beijing, started in December 1993, entered the stage of actual computations in November 1994 and continued in 1995, reaching the important result to give a simple and physically sound explanation of the observed concentration of large damage in the Xiji-Langfu district of the town, observed as a consequence of the M=7.8 Tangshan earthquake of 1976. For Bucharest it was decided, during a meeting of the COPERNICUS project "Quantitative seismic zoning of the circum Pannonian region (QSEZ-CIPAR)" held in Prague (21-22 November 1995), to start the data collection for microzoning in order to be able to perform the actual computations at ICTP in 1996.

QSEZ-CIPAR is a quite successful project, coordinated at ICTP, involving the collaboration among Czech, Hungarian, Italian, Romanian, Slovenian, and British scientists, and, in the Communication from the Commission "Perspectives for International Cooperation in Research and Technological Development" (CB-CO-95-537-EN-C) of October 1995, it was chosen by the European Commission as the example of Research and Technological Development (RTD) among the hundreds of COPERNICUS projects.

In addition, for the IDNDR work of the task Group, funding by the European Commission is allocated in the framework of the "Long Period Earthquake Risk in Europe (LPRISK)" project, for the methodological aspects (participating countries: France, Greece, Italy, Portugal, Spain and the United Kingdom), and by ICTP for the local applications, and support from the Italian-Chinese bilateral agreement for science and technology is provided. Recently the State Science Technology Committee (SSTC) of China has allocated two-years (1996-1997) support to the project of microzoning of Beijing, while the microzoning of Rome, Naples and Benevento continues with international support from the European Union contracts "Observation and modelling of heterogeneities in seismic sources and crustal structures for seismic hazard assessment around active faults in the Mediterranean region" and "Development and experimental validation of advanced modelling techniques in engineering seismology and earthquake engineering". Instrumental to the activities of the Task Group work for IDNDR has been the contract "Earthquake hazard associated to the Vrancea region seismicity", funded by NATO.

The study of the lithosphere of the Ethiopian rift system and surrounding plateaux, continued,

funded by ICTP (Associates scheme and TRIL Program) with the involvement of the Universities of Addis Ababa and the Arbaminch Water Technology Institute (North Omo), and a new project started in Madagascar with the support of ICTP (Associates scheme) to mitigate the seismic risk of Antananarivo.

Special attention was paid to the development of the analytical computation of partial derivatives of synthetic seismograms with respect to source and structure parameters that will greatly contribute to the efficiency of parametric studies and will be widely used in the inversion algorithms employed in Project 4 (see below).

The research is being done in collaboration with Regular Associates and Visiting Scientists from Algeria, Bulgaria, China, Colombia, Croatia, the Czech Republic, Denmark, Ethiopia, France, Hungary, Madagascar, Mexico, Norway, Romania, Russia, Slovenia and UK. Scientists working on this project are J. Acosta, A. Aoudia, F.K. Alamneh, L. Ardeleanu, J. Bekkevolt, I. Bondar, H. Bungum, Z. Bus, P. Campus, G. Costa, H. Dufumier, D. Enescu, D. Faeh, J. Frez, M. Herak, A. Jemberie, A. Levshin, T. Mammo, F. Marrara, R. Musson, C. Nunziata, Z.N. Oparina, M. Radulian, G. Rambolamana, L. Ratnikova, A. Sarao, J. Sileny, I. Stanishkova, P. Suhadolc, R. Sun, I. Turetsky, L. Urban, F. Vaccari, P. Varga, S. Vuan, M. Zivcic and G. Woo.

Project 4 (led by F. Schwab). "Three-dimensional mapping work of the ILP Task Group".

We are concentrating on the detailed planning and funding of our 3-D mapping operations, in what have become the Task Group's seven main geographic regions:

1. Region A. China, Mongolia, southern and eastern seas bordering China, India and bordering seas, and Northwestern Pacific.
2. Region B. Western Hemisphere.
3. Region C. Near and Middle East — Turkey, Cyprus, Syria, Jordan, Iraq, Saudi Arabia, Yemen, Oman, United Arab Emirates, Qatar, Bahrein, Kuwait, Iran, Afghanistan, Pakistan, and the associated bordering seas.
4. Region D. Arctic, Europe, former Soviet Union, Mediterranean, Northeastern Atlantic, and Northwestern Africa (Libya, Tunisia, Algeria and Morocco).
5. Region E. Africa, Madagascar and surrounding oceans.
6. Region F. Southeast Asia and the Southwestern Pacific.
7. Region G. Antarctica and surrounding oceans.

As a result of what we learned at the ICTP-supported first regional meeting of the Task Group in Chengdu, China (September 1993), and subsequent interactions at ICTP of our local-center leaders (several of whom are now ICTP Associates) with the founders and leaders of the Centre Task Group, in 1995 we held the first India workshop at Banaras Hindu University in Varanasi, the initial India organizational meeting at the Indian Institute of Technology in Kanpur, and the first China workshop at the Seismological Bureau of Fujian Province in Fuzhou. Personnel: F. Schwab (international organization, lead instructor); R. Mehlman, J. Acosta Chang, L. Ardeleanu, E. Nyland, Z.J. Du (instructors); A. Ram, R.P. Singh, X.X. Chen, D.Q. Yuan, and Y.T. Chen (local organization).

Outline of these Part 1 schools:

School of the Inter-Union (IUGG-IUGS) Commission for the Lithosphere/International Lithosphere Program Task Group II-4 "Three-Dimensional Modelling of the Lithosphere and Asthenosphere".

Specific Plan for Application of the Multimode/Multistructure Procedure to Three-Dimensional Mapping, Part 1:

a. Database and Preliminary Inversion Considerations.
b. Extensive Overview of Multimode/Multistructure Procedure.
c. Design of Hardware System for Local-Center Use.

1. *General Introduction*
   a. Task Group II-4 of the International Lithosphere Program "Three-Dimensional Modelling of the Earth's Lithosphere and Asthenosphere".
   b. Three-Dimensional Maps of the Earth's Structure.
   c. Interdisciplinary 3-D Mapping Procedures.
   d. Procedures for Improving the Initial 3-D Maps.
2. Specific Procedures
   a. Overview of the Entire Multimode/Multistructure Procedure and its Use.
   b. Design of Hardware System for Local-Center Use.

3 Practical Workshop Treatment of the Surface of the Earth
   a Introduction
   b Geodesy — the Geoid
   c Geography
4 Specific Procedures

Initial Testing for Successful Resolution from a Given Set of "I", "J", "K", and "L" Databases (in the region of China, Mongolia and the southern and eastern seas that border China)

5 Specific Procedures and Practical Workshop Electronic, Digital Representation of the 3-D Structure of the Earth — the "I" Data Set
6 Specific Procedures
   Electronic, Digital Specification of the Focal Mechanism for each of the Earthquakes used in the Procedure for Improving our 3-D Structural Model — the "J" Data Set
7 Practical Workshop
   "I"-Data-Set Construction, Checking, and Correcting
8 Practical Workshop
   "J"-Data-Set Construction
9 Specific Procedures
   Seismological Data to be used in the Improvement of the "I" Data Set with the Multimode/Multistructure Method — the "K" Data Set
10 Practical Workshop
   "I"-Data-Set Practical Exercises
11 Demonstration
   The "I" Data Set for the 3-D Structure beneath the Arctic and North Atlantic
12 Specific Procedures and Practical Workshop
   a Instrument-Response Functions to be used to Convert Computed Time Series of Ground Displacement into Theoretical Seismograms — the "L" Data Set
   b "I"-Data-Set Preparation of the Visual Representations Necessary for Displaying and Distributing the "I"-Data-Set Results"

In 1996 we hope to begin presenting combined, workshops/planning meetings in Africa, and to continue with more advanced workshops in India and China The initial arrangements have already been made for these conferences, and funding is now being sought for them

The initial research results from the 3-D mapping project were reported in 1995 at the IUGG XXI General Assembly in Boulder, Colorado, USA This was at IASPEI session SW16 "Database of 3-D Structure of Lithosphere and Asthenosphere", which was devoted solely to the work of the Centre Task Group The next level of research results from the 3-D mapping project are to be reported in 1996 at the 30th International Geological Congress in Beijing

In 1995 our largest gains, in evolving toward developing a 3-D map beneath the entire surface of the earth, were in Africa There, to our original five centers (Tanta and Giza in Egypt, Khartoum in Sudan, Addis Ababa in Ethiopia, and Antananarivo, Madagascar), we added eight from the Eastern and Southern Africa Regional Seismological Working Group (Asmara in Eritrea, another in Addis Ababa, Entebbe in Uganda, Nairobi in Kenya, Dar-es-Salaam in Tanzania, Lomba in Malawi, Lusaka in Zambia, and Bulawayo, Zimbabwe), and three centers from the International Commission for Earth Sciences in Africa (Kumasi in Ghana, Ibadan in Nigeria, and Buea in Cameroon) The final recruitment effort in Africa then focused on attempting to establish centers at Dakar or M'Bour in Senegal, at Kinshasa, Kisangani, Bukavu, and Lubumbashi in Zaire, at Bangui in the Central African Republic, at Luanda in Angola, and at the National Research Institute of Astronomy and Geophysics in Helwan, Egypt During 1995 we were also able to begin the development of Antarctic mapping work, with the entrance into our project of the Observatory for Experimental Geophysics (OGS), Opicina (Trieste), Italy, and finally, with the help of our Bucharest center we began the recruitment that will be necessary for the mapping work — database development — on the structure beneath Eastern Europe and the Former Soviet Union

The research was carried out in collaboration with an ICTP Affiliated Centre leader, Regular Associates of ICTP, Visiting Scientists and Local-Center Scientists from Africa (J A Abdalla, M G Al-Ibiary, S N Ayonghe, A I Bayoumi, L S Chapola, E W Dindi, D Ghebrettatios, D J Hlatywayo, A B Kampunzu, R M Kebeasy, F Kebede, D K Lombe, I Marobhe, Y E-A Mohamedzein, I O Nyambok, E A Oni, G Rambolamanana, M Tilahun, K E N Tsidzi, G Turymurugyendo), from Australia (K Sundaralingam), from Canada (E Nyland), from China (J M Cao, X X Chen, Y T Chen, C Q Fan, J Fang, Y Gao, H T Hsu, X G Li, S C Liu, R F Liu,

S.M. Liu, Z. Liu, T.X. Qiu, R.M. Sun, X.X. Wang, P.L. Wang, C.J. Wu, D.H. Yiang, D.Q. Yuan, H. Zhao, J.F. Zhu, J.S. Zhu, Y.Q. Zhu), from England (W.J. Mao), from India (B.N.P. Agarwal, S.N. Bhattacharya, M.K. Bhowmic, D.N. Chaudhary, V.K. Gaur, R. Juneja, K.N. Khattri, D.C. Mishra, K.S. Mohan, J.P. Narayan, Sri Niwas, O.P. Pandey, I.A. Parvez, N. Patel, A. Ram, K.K. Roy, R.P. Singh, V.C. Thakur, I.P. Tiwari, G.S. Yadav), from Italy (Z.J. Du, A. Michelini, G.F. Panza, F. Romanelli), from Mexico (J. Acosta Chang, J. Frez Cardenas, J. Carlos Villegas), from Romania (L. Ardeleanu, D. Enescu, M. Radulian), and from the USA (L. Knopoff, F. Leader, R. Mehlman, F. Schwab, J. Somers).

A common objective for the four projects is to collect and organize all available seismological geophysical and geological datasets into a digital information system to be processed with the Arcinfo Geographic Information System (GIS) software. The development of such kind of database is a major effort with significant impact on earthquake research and seismic hazard mitigation.

Training activity

Third workshop on non-linear dynamics and earthquake prediction, 6 - 17 November 1995 (see on Pages 102-105).

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F. Schwab and J.S. Zhu. Interdisciplinary 3-D Mapping Procedures.

P. Suhadolc, F. Vaccari, G. Costa, G.F. Panza. Contribution to the seismic zoning of Italy and microzoning of Rome and Benevento.

J.S. Zhu and R.M. Sun. Database of 3-D Structure Beneath China, Mongolia, and the Southern and Eastern Seas that Border China.

Papers that will be presented at the 30th International Geological Congress - Special Symposium D-2 "Three-dimensional models and four-dimensional mapping of the lithosphere", Beijing, 4-14 August 1996.

B.N.P. Agarwal and R.K. Shaw. Mapping of density variations from gravity field data over Indian region.

L. Ardeleanu and M. Radulian. Database for 3-D map of the upper mantle beneath the Kamchatka peninsula and its environment.

Z.J. Du, A. Michelini and G.F. Panza. Seismogram synthesis using the "I" data set of Europe.

J. Frez and J. Acosta. Construction of database for the 3-D map of the upper mantle: The Arctic and North Atlantic.

W.J. Mao. Rapid 2-D and 3-D seismic modelling based on ray tracing.

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A. Ram. Database of 3-D structure beneath India and surrounding coastal waters: A progress report.

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Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	4	
Asia	4	
Europe	25	15
South America	1	
Total	*34*	*15*
Grand Total	***49***	
Countries represented	17	
Person-months	169.52	

* * * * * * * * * * *

Title: CLIMATE AND GLOBAL CHANGE GROUP

Dates: Throughout the year

Co-ordinators: Professors V Krishnamurthy (IISc, Bangalore, India and ICTP) and J Shukla (COLA/IGES, Center for Ocean-Land-Atmosphere Studies, Institute of Global Environment and Society, Calverton, Maryland, USA)

1) Climate Data Bank. A dramatic improvement was done in 1995 in the ICTP Climate Data Bank development In the previous years, an enormous amount of climate data was already installed in the ICTP system In 1994, an attempt was done to obtain also real time weather data (observations and daily updated model forecast) from the Italian Weather Service, but the very high price involved made this target not affordable

But in 1995, another possibility was explored Since the US National Meteorological Center (NMC) adopts a policy of distributing most of its medium range forecast output, and COLA is one of the recipients, the acquisition of updated daily model forecast from NMC was decided COLA makes available daily through Internet a ten-day updated forecast performed at NMC with a Medium Range Forecast (MRF) General Circulation Model for the entire globe. Therefore a completely automated system, which was showed during the Advisory Committee Meeting in November 1995, was installed at ICTP The system connects every day to COLA, runs remotely a program that extracts a transportable sub-set of real time model's output (including Europe and the entire Mediterranean basin), compresses the data and transfers them to the ICTP Climate Storing facilities, making the data available to any user, for educational and scientific purposes

The second part of the project involved the creation of the proper software, in order to allow any user to access the mrf Using GrADS, the graphics package developed by COLA, and installed at ICTP in its later version, a user-friendly program that allows the display of the mrf data in a color and very self explanatory way was developed Any user now, from any color workstation of ICTP can visualize the mrf weather data Of course there is a tremendous scientific and educational utility in having real time daily updated model forecast on line Also, it must be said that right now there is no other place in Italy accessing to such a large and complex amount of climatological and meteorological data Besides the daily nmc mrf weather forecast (of which at least 70 runs are already stored and available in the ICTP Climate Data Bank also for further research), also other climate data were installed at ICTP during 1995 A 20 year integration of the COLA GCM, at R15 resolution (approx 4x7 degrees, prosecution of the first 5 years integrated in 1994, which brings to 25 the length of the run), was put in the system in January, and a 5 summer cycles integration at high resolution (approx 1 8 x 2 8) degrees was also installed in the system in August The latter was done with the most recent version of the COLA GCM, updated with a new convection scheme, and therefore is an extremely up to date model output for climate research

2) Research

In 1995, using the internet connection of ICTP, the results of two large climate experiments were installed, analyzed and studied at ICTP Those two experiments are coupled with the two above-mentioned integrations ("control" runs), and they are all identical but for their boundary conditions Since my research is mainly devoted to the climatic effects of the human activity over the Mediterranean, the two experiments have the aim of calculating the effects on climate due to the deforestation performed around the Mediterranean in the last 2000 years Therefore, the boundary conditions that was changed is the vegetation around the Mediterranean The integration was done using the supercomputer facilities available from COLA, but all the data were transferred at ICTP During the period in 1995 that I spent at ICTP, I performed the postprocessing and an accurate statistical comparison between the two control runs and the two experiments with altered boundary conditions These experiments are mainly possible because of the Simple Biosphere Models (SiB) or its later simplifications (SSiB) implemented in the COLA-GCM (Sellers et al , 1986, Xue et al , 1991) With this tool, that couples the atmosphere with the biosphere, it is possible to evaluate the impact on climate of human activities like deforestation

The importance of Climate history is very relevant for Global Change studies, since it is not possible to predict any future climate change if we do not understand deeply the climate changes of the recent historical past A lot of effort has been devoted to study the climate of the

geological past, but little is known of the more recent historical past (i.e., the last 2500 years). The importance of this study is related to the fact that nobody has performed yet a GCM simulation having as object the climate of the Mediterranean in the historical past, in despite of the fact that there is a tremendous evidence that mediterranean climate has been drifting towards drier conditions for the last few thousands years. The main results of the experiments shows that the human role is very relevant, and that might have acted towards a desertification of Northern Africa and Middle East in terms of climate conditions.

O. Reale

REFERENCES

P.J. Sellers, Y. Mintz, Y.C. Sud and A. Dalcher, 1986: A Simple Biosphere Model (SiB) for Use within General Circulation Models. J. Atmos. Sci., 43, 505-531.

Y.-K. Xue, P.J. Sellers, J.L. Kinter and J. Shukla, 1991: A simplified Biosphere Model for Global Climate Studies. J. Climate, 4, 345-364.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
North and Central America		2
Total		*2*
Grand Total	***2***	
Countries represented	1	
Person-months	4.67	

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Title: INTERNATIONAL SYMPOSIUM ON AFRICAN DROUGHT

Dates: 31 July - 4 August.

Co-sponsors: Third World Academy of Sciences (TWAS, Trieste, Italy), Office of Global Programs of the National Oceanic and Atmospheric Administration (OGP/NOAA, Washington DC, USA), World Meteorological Organization (WMO, Geneva, Switzerland), the National Science Foundation (NSF, USA), and the World Bank.

Directors: Professors G. Furlan (University of Trieste and ICTP), V. Krishnamurthy (Indian Institute of Science, Bangalore, India, and Center for Ocean-Land-Atmosphere Studies, Calverton, MD, USA), J. Shukla (Center for Ocean-Land-Atmosphere Studies, Calverton, MD, USA), and Lei Zhaochong (World Meteorological Organization, Geneva, Switzerland).

Scientific Organizing Committee: M.S. Boulahya (Centre Africain pur les applications de la météorologie au développement, ACMAD, Niamey, Niger), J. Buizer (Office of Global Programs, National Oceanic and Atmospheric Administration, OGP/NOAA, Silver Spring, MD, USA), J. Kinuthia (Kenya Meteorological Department, Nairobi, Kenya), P. Lamb (Univ. of Oklahoma, Norman, USA), Lei Zhaochong (World Meteorological Organization, Geneva, Switzerland), S.H. Mwandoto Isangaiwishi (Kenya Meteorological Department, Nairobi, Kenya), S.H. Nicholson (Co-Chair; Florida State University, Tallahassee, USA), F. Semazzi (North Carolina State University, Raleigh, USA), J. Shukla (Co-Chair), and C. Toulmin (IIED, UK).

Report:

1) Drought is a recurrent and often devastating feature of the sub-Saharan African climate and is closely related to the problem of achieving sustained and adequate agricultural production

in most countries of this area As such, it cannot be ignored in planning for development, and it is attracting more and more interest on all levels Before discussing the effects and their alleviation, one must first identify the causes of this phenomenon Indeed the main objectives of the Symposium were

a) to describe and understand the interannual variability of sub-Saharan climate,
b) to assemble the most up-to-date information on the nature and causes of sub-Saharan drought, as well as the relevant predictions (seasonal rainfall forecasting),
c) to examine the complex relationship between the human and biological environment and the present sub-Saharan drought,
d) to discuss some socio-economic aspects

These themes were developed in a series of lively sessions with a large number of African lecturers and participants They offered an interesting overview of many observations and monitoring campaigns, concerning the natural and human factors related to drought (rainfall, global radiation, climate anomalies, agricultural techniques, land management, socio-economic issues, and so on)

Of special interest was a panel discussion devoted to the state-of-the-art of scientific knowledge on African drought A short presentation on several organizations and programmes in this domain (UNEP, ACMAD, MEDIAS, IGBP) also proved very useful

The audience was composed of about 100 researchers (250 applicants) from universities and national meteorological services, of which more than half from African countries, and with a large French-speaking group (Incidentally, the participants from the French-speaking countries had difficulty following the lectures and summaries in French had to be provided) I was pleased to ascertain the enthusiasm and good level of competence shown by those researchers, as confirmed in their contributions

The Symposium offered high quality and quantity thanks to a carefully designed scientific programme by an organizing committee chaired by Prof J Shukla From a scientific standpoint, the contributions confirmed the existence of a clear correlation between distant phenomena, the best studied example being Rainfall Anomalies in West Africa (Sahel) and Sea Surface Temperature Variations in the Tropical Atlantic Dynamically this feature in the Sahel area can be explained by a "Sea-Air Interaction" which produces changes in atmospheric circulation and moisture transport This mechanism has to be confronted with the so-called "Charney Effect" based on the increase of the surface albedo of the Earth which tends to suppress cloud formation and precipitation These are considered to be the driving elements of the phenomenon, even if the relative importance of these two factors is not easy to ascertain

The idea that prolonged drought in Africa can be considered as a warning sign of climate change was one of the issues debated during the event

As a matter of fact, it was stressed that a great deal of progress was made possible thanks to the improvements in modelling and computer simulation and monitoring techniques Multidisciplinary studies remain, however, indispensable for a better global insight

2) The Symposium was jointly organized by the World Meteorological Organization (WMO, Geneva), the National Science Foundation (NSF, Washington) and the National Oceanic and Atmospheric Administration (NOAA, Washington), which also provided substantial funding (more than half the total cost) While the collaboration with the WMO has been going on for the past 5 years, with mutual satisfaction, the novel interest of the NSF and NOAA was substantiated by the active presence of one representative from each organization, Ms F Li and Mr J Buizer (respectively), who visited the ICTP for the first time I had the opportunity of discussing with them possible avenues of future collaboration This matter should be further pursued in view of the excellent impression that the ICTP programmes and achievements have had on those visitors

During the discussions with the NSF and NOAA representatives, their suggestion was to pay a visit to the relevant institutions in the USA in connection with the International Forum on El Niño (Washington DC, 6 - 8 November 1995)

G Furlan

Programme:

J SHUKLA (USA) – Sub-Sahara drought Natural variability or irreversible climate change?

Session 1: Mean Climate

S.E. NICHOLSON (USA) (Invited) – General characteristics of African mean climate and its variability.

V. MORON (France) – Relationships between OLR-HRC and rainfall at monthly scale in tropical Africa.

S. BIGOT (France) – Relationships between the interannual rainfall variability and the annual cycle in Africa (presented by V. Moron).

C. BOUKA BIONA (Congo) – Evolution saisonnière de l'échelle spatiale du rayonnement solaire global en zone Sahelienne.

Session 2: Interannual Variability

P. LAMB (USA) (Invited) – On Sahelian disturbance line characteristics and tropospheric structure: A climate perspective from daily observations.

H.N. BHALME (India) – Persistent rainfall deficit over the western Sahel during last two decades — Perhaps a manifestation of the natural variability of the coupled ocean-land-atmosphere system.

M. BA (Mauritania) – Satellite-derived interannual variability of west African rainfall during 1983-88.

L. BAH (Guinea) – Time-space rain variability in Guinea.

B.E. BOKONON-GANTA (Benin) – Climatic variability in the dry coastal belt of West Africa.

M. INDEJE (Kenya) (Invited) – Space-time rainfall variability over eastern and central Africa (1951-1990) and its relationships to ENSO.

P. CAMBERLIN (France) – June-September rainfall anomalies in eastern Africa: Influence of the Indian summer monsoon.

C. SRINIVASA RAO (Brazil) – Interannual variations of cold cloud duration over sub-Saharan Africa.

A. MAKARAU (Zimbabwe) – Climatic variability over central southern Africa with special emphasis on Zimbabwe.

Session 3: Mechanisms (Modeling)

F.H.M. SEMAZZI (USA) (Invited) – The role of large-scale orography in modulating the African droughts.

D. ROWELL (UK) (Invited) – Variability of summer rainfall over tropical north Africa (1906-92): Observations and modelling.

Y. XUE (USA) – Biosphere feedback on regional climate in the semiarid Sahel.

D. ENTEKHABI (USA) (Invited) – Water vapor flux and rainfall: Insights into drought forcings.

G. N'TCHAYI MBOUROU (Gabon) – Modification de la répartition spatiale des aerosols désertiques en Afrique au nord de l'équateur sur 3 périodes: 1957-61, 1970-74 et 1983-87.

S.J. MASON (South Africa) – Modelling droughts over southern Africa.

Session 4: Mechanisms (Observations)

M. JURY (South Africa) (Invited) – Causes, structure and prediction of drought in Southern Africa.

A.W. MAJUGU (Uganda) – ENSO triggered droughts in equatorial eastern Africa and prospects for prediction.

E.J. MPETA (Tanzania) – Case study of 1993/94 drought in Tanzania.

D. SHANKO (Ethiopia) – The effects of the southwest Indian ocean (SWIO) and the Arabian sea tropical cyclones on Ethiopian drought.

B.M. DIALLO (Niger) – Characteristics of rain producing systems over Niger during wet and dry years.

G.K. MATHER (South Africa) – Some possible influences of aerosols on cloud microstructure in sub-Saharan Africa.
S. JANICOT (France) – West African droughts and inter-tropical zonal circulations.
S.E. NICHOLSON (USA) – ENSO-SST-rainfall associations in relationship to drought in Africa.
F.O. ODEMERHO (Nigeria) – Interannual variability of rainfall regime and drought in West Africa: a causal interpretation.
J.A. ADEDOKUN (Nigeria) – On bio-physical feedback mechanisms associated with the Sahelian drought.
C. SRINIVASA RAO (Brazil) – Comparison of ECMWF-derived diabatic heating with meteostat-derived cold cloud duration data.
W. ZHAKATA (Zimbabwe) – Relationships between sea-surface temperature and rainfall variability in southern Africa.

Session 5: Prediction
W. THIAO (Senegal) (Invited) – Monitoring and predicting drought in tropical Africa.
S. YILMA (Ethiopia) – A stochastic prediction of summer rains over Ethiopian highlands Africa.
A.W. COLMAN (UK) – Real-time seasonal forecasts of sub-Saharan rainfall.
L.S. UNGANAI (Zimbabwe) – A rainfall prediction scheme for southern Africa based on the Southern Oscillation phenomenon.
D.M. LeCOMTE (USA) – SST anomalies in the equatorial Pacific and their relationship to corn yield in southern Africa (presented by W. Thiao).
W.A. LANDMAN (South Africa) – The South African long-lead forecast forum.
N. WARD (United Kingdom) – Analysis and prediction of African climate.

Session 6: Socio-Economic Aspects
E.W. NAFZIGER (USA) (Invited) – Irreversible environmental damage, investment criteria, and multilateral aid in West Africa.
S.H. MWANDOTO (Kenya) – Socio-economic impacts of droughts in Kenya.
A.B.A.G. BABIKER (Sudan) – Some socio-economic impacts of drought upon the large urban centres of Sudan with a special reference to Khartoum.
D. NORMAN (USA) (Invited) – African drought: Impact on rural livelihoods and implications for development.
M. MUCHINDA (Zambia) – Drought in Africa — Socio-economic issues.
M. AKHTAR (Germany) – Desertification.
A. TARHULE (Nigeria) – The role of shallow ground water in semi-arid environments: Case study of north eastern Nigeria.
S. ZOGHBI (Algeria) – Risques climatiques et practiques agricoles dans les hautes plaines Algériennes.
T. DINKU (Ethiopia) – The use of satellite data for drought monitoring.

Session 7: Monitoring (Mitigation and Management)
M.R. HELFERT (USA) (Invited) – Deterioration of the Sahelian environment since 1965.
L. SOME (Burkina Faso) – A study of runoff and erosion effects on water balance and sorghum yields in Burkina Faso.
J.O. OWILI (Kenya) – Role and potential of mulching and alley cropping in combating the African drought: A review.
A. ALUSA (Kenya) – The activities of UNEP in Africa relevant to the amelioration of the impacts of drought on the African societies.
R. HAMMOUCHE (Algeria) – ACMAD Activities.
S. JANICOT (France) – MEDIAS Activities.

T.R. HEDDINGHAUS (USA) – The African Desk: A training program for African scientists (presented by W. Thiao).
B.J. GARANGANGA (Zimbabwe) – Monitoring Center in Harare.

Panel discussion: Outstanding issues and directions for future research.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	50	
Asia	1	
Europe		16
North and Central America		24
South America	1	
International Organizations		2
Total	52	*42*
Grand Total	***94***	
Directors and Lecturers	4	
Participants	90	
Countries represented	33	
Int'l Organizations represented	2	
Person-months	31.72	
Applications received	250	

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Title: COLLEGE ON SOIL PHYSICS

Dates: 11 - 29 September.

Co-sponsor: Kuwait Foundation for the Advancement of Sciences.

Directors: Professors D. Gabriels (State University of Ghent, Belgium), GC. Ghirardi (University of Trieste and ICTP), D.R. Nielsen (University of California, Davis, CA, USA), I. Pla Sentis (Universidad Central de Venezuela, Maracay, Venezuela) and E. Skidmore (US Department of Agriculture, Kansas State University, Manhattan, Kansas, USA).

Purpose: To provide participants with a fundamental understanding of soil physical properties and processes so that they may apply the knowledge gained to solving problems in soil physics.

Report: It has to be stressed that this was the sixth of a series of Colleges in this field, an activity which started in 1983 and has been repeated every two years, with the only exception of 1991, a year in which the financial difficulties of ICTP made it necessary to cancel the already scheduled and almost completely organized College.

The Directors of the College were Profs. D. Gabriels (Belgium), GC. Ghirardi (Italy), D. Nielsen (USA), I. Pla Sentis (Venezuela) and E. Skidmore (USA). Out of these, D. Gabriels and E. Skidmore have been the proponents of the Soil Physics activity and have been among the Directors of all Colleges held up until now.

Besides the Directors, who themselves delivered a remarkable number of lectures, we had 6 lecturers from Belgium, Bolivia, Brazil, Czech Republic, Italy and the Netherlands. Some of them

had been lecturers in previous Colleges As in the last College, we tried to keep the number of lecturers quite small (correspondingly allocating heavy teaching loads to the lecturers and Directors) to stay within the quite limited budget without reducing the number of participants to an unacceptable level I would like to stress that the spirit of co-operation of the Directors and lecturers, as well as the intelligent and careful programming and the strict selection procedure for the College, had enabled us to remain strictly within the allocated budget, and also to keep the level and attendance of the College to a good standard It is the common opinion of all the Directors that, from the point of view of the preparation and the direct involvement of the participants, the present one has surely been the best College up until now

There were 53 lectures delivered during the College We had chosen to improve remarkably, with respect to the previous Colleges, the direct involvement of participants. This was achieved by devoting an appreciable part of the activities to presentations by participants During these presentations, 17 participants delivered short lectures presenting their own original research work and/or by members of the groups to which they belong in their home institutions The Directors and lecturers unanimously expressed their satisfaction of the high scientific level of these presentations

The topics covered ranged from a synthetic but general overview of the subject to specific problems such as classification of soils, analysis of their physical and chemical properties, soil conservation, water erosion, soil degradation, wind erosion and theoretical models The accent was on more technical aspects of the field than in previous Colleges The physical and chemical properties of soils and the corresponding relevant physical processes such as water diffusion, soil degradation, erosion etc , were dealt with in all details with a systematic study of the relevant model equations describing such processes Specific and sophisticated techniques ranging from the use of gamma radiation, neutron probes, computerized tomography and computer simulation and computer data handling were the subject of a series of lectures The statistical approach to evaluate the reliability of techniques to collect data, as well as to take appropriately into account and compensating for the extreme spatial and temporal variability of soil properties were also discussed The aim was to introduce more efficient and appropriate methods for specific management practice

As the previous Colleges, also the present one was, in my opinion, a remarkable success This was mainly due to the exceptional devotion and human qualities of the Directors and lecturers All of them were at the complete disposal of the participants for discussions, suggestions etc for the whole period of the College It was an extremely interesting experience to see a community of people (the participants) who had never met before, becoming in a very short time, a highly interactive group with very good human relationships but, more importantly, with a great desire of exchanging views and of establishing fruitful scientific interactions

The attendance during the College was extremely high Also, as is usual for this activity, we requested all participants to fill in a very detailed questionnaire, expressing their remarks, criticisms and suggestions The questionnaires were considered by Prof Skidmore who will present a detailed report At any rate, I feel quite safe in anticipating, on the basis of the many contacts I had with them, that the College has been extremely useful for the large majority of the participants This is not surprising the dedication of the Directors and the lecturers, the good preparation of the participants and the fact that the College deals with problems which are of extreme relevance for many developing countries, makes this activity particularly important and successful

I feel the duty to stress that, in my opinion, this activity is of extreme relevance and has a great impact, particularly for the least developed countries, where a more scientifically qualified way to tackle the problem of soil conservation may have an important effect

GC Ghirardi

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	27	
Asia	13	
Europe	10	8
North and Central America		2
South America	13	
Total	*63*	*10*
Grand Total	***73***	
Directors and Lecturers	11	
Participants	62	
Countries represented	33	
Person-months	44.48	
Applications received	163	

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Title: WORKSHOP ON MEDITERRANEAN SEA — CIRCULATION, STRAIT EXCHANGE AND DENSE WATER FORMATION PROCESSES (dedicated to Antonio Michelato)

Dates: 23 - 27 October.

Co-sponsors: Osservatorio Geofisico Sperimentale (Trieste, Italy) and University of Trieste.

Directors: Professors G. Furlan (University of Trieste and ICTP), M. Gacic (Osservatorio Geofisico Sperimentale, Trieste), R. Mosetti (Osservatorio Geofisico Sperimentale, Trieste), and F. Stravisi (University of Trieste).

Purpose: To provide participants, especially colleagues and friends of Antonio Michelato, with a forum to exchange ideas and views on the most recent research activities in the Mediterranean Sea.

Programme:

R. MOSETTI (Osservatorio Geofisico Sperimentale, Trieste, Italy) – Commemoration for Antonio Michelato.

A. Warn-Varnes, S. PIACSEK (Stennis Space Center, Mississippi, USA) – Observational and Numerical Studies in the Northern Tyrrhenian Sea.

P. LA VIOLETTE (Stennis Space Center, Mississippi, USA) (Invited) & R.A. Arnone – The Use of NOAA AVHRF.

P. POULAIN (Saclant Undersea Res. Center, La Spezia, Italy) – Surface Circulation in the Adriatic and Ionian Sea as Measured by Lagrangian Drifters.

L. BEALE (Southampton Oceanography Centre, UK) (et al.) – Deep Water Mass Property Changes in the Mediterranean.

J.P. BETHOUX (Laboratoire de physique et chimie marines, Villefranche-sur-Mer, France), B. Gentili – The Mediterranean Sea Dynamics, a Challenge for Climatic and Environmental Studies.

C. MILLOT (Antenne COM-CNRS, La Seyne, France) – The Formation and Circulation of the Intermediate and Deep Water in the WMS.

M. GACIC (Osservatorio Geofisico Sperimentale, Trieste, Italy) (invited) – Physical Oceanography of the Adriatic Sea.

P. LA VIOLETTE (Stennis Space Center, Mississippi, USA) (invited) – Satellite Data Studies of the Adriatic Sea.
E. OZSOY (Middle East Technical University, Erdemli, Turkey) (invited) – Interannual Climatic Variability of Sub-Basin Scale Processes in the Levantine Sea.
A. ROBINSON (Harvard Univ., Cambridge, MA, USA) (invited) – Real-time Forecasting and Dynamical Process Studies in the Eastern Mediterranean.
A. LASCARTOS (Athens Univ., Greece) (invited) – A High Resolution Numerical Study of LIW Formation.
J.C. NIHOUL (Université de Liège, Belgium) (invited) – Investigation of the Western Mediterranean Hydrodynamics with the GHER 3-D Primative Equation Model.
W. ROETHER (Universität Bremen, Germany) (et al.) (invited) – An Account of Ongoing Deep-Water Transient in the Eastern Mediterranean.
P. MALANOTTE-STONE (Massachusetts Inst. of Technology, Cambridge, MA, USA) (invited) – General Circulation of the Mediterranean Sea and Modelling.
N. PINARDI (Ist. per lo studio delle metodologie geofisiche ambientali, Modena, Italy) (invited) – Interannual Variability of the Mediterranean Sea General Circulation.

Oral Presentations by Participants.

Round Table: "Oceanographic Studies of the Mediterranean: Present and Future", held on 26 October at Stazione Marittima - Centro Congressi (Trieste).

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Europe	26	54
North and Central America		4
South America	3	
International Organizations		1
Total	*31*	*59*
Grand Total	***90***	
Directors and Lecturers	14	
Participants	76	
Countries represented	19	
Int'l Organizations represented	1	
Person-months	25.24	
Applications received	108	

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Title: THIRD WORKSHOP ON NON-LINEAR DYNAMICS AND EARTHQUAKE PREDICTION

Dates: 6 - 17 November.

Co-sponsor: International Council of Scientific Unions (ICSU, Paris, France).

Directors: Professors V.I. Keilis-Borok (International Institute of Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) and

G.F. Panza (University of Trieste).

Purpose: To stimulate research on new approaches to earthquake prediction, based on exploratory data analysis on the phenomenological side and on the theory of non-linear dissipative systems, on the theoretical side, with particular attention to dynamic models of earthquake occurrence.

Report:

Structure and organisation

The program of the Workshop included lectures, exercises, and computer exercises. After the Workshop the participants received the software which realises the algorithms studied.

During the Workshop the meeting on the Project "INTERMEDIATE-TERM EARTHQUAKE PREDICTION" within the framework of the International Decade for Natural Disasters Reduction (IDNDR) was organised. This meeting was supported by Scientific Committee of the International Council of Scientific Unions (ICSU).

Participation

The participants of the Workshop represented 32 countries. The main part of them were of Ph.D. level. Several leading geophysicists gave lectures at the Workshop. During discussions with the lecturers, the participants from developing countries had possibility to formulate scientific projects for future studies.

Scientific content

Lectures were given on the following topics:

- Non-Linear Dynamics and Earthquake Prediction. Complexity and Chaos. Multifractal and Wavelet Analysis of Fault Structures: Evidence of Hierarchical Organisation of Characteristic Scales. Discrete Scale Invariance (I: Introduction and Experimental Evidence in Rupture, Earthquakes and Other Phenomena. II: Theory). Self-Organized Criticality.
- Analysis of Earthquake Catalogs. Functions on Earthquake Flow. Magnitude Spectrum of Earthquakes. Software for Analysis of Dynamics of Seismicity. Statistics of Seismicity.
- Earthquake Prediction and Earthquake Preparedness. Premonitory Activation of Seismicity: The Algorithms "M8" and "Mendocino Scenario". CN Application to Italy and Microzoning. Long-periodic Precursory Seismicity. Evaluation of Earthquake Prediction.
- Numerical Simulation of Block Structure Dynamics. Statistical Mechanism of Earthquakes.
- Pattern Recognition.

Exercises and Computer Exercises were organised on the following topics:

- Analysis of Earthquake Catalogs. Functions on Earthquake Flow. Software for Analysis of Dynamics of Seismicity.
- Premonitory Activation of Seismicity: The Algorithms "M8" and "Mendocino Scenario".
- Numerical Simulation of Block Structure Dynamics.
- Pattern Recognition.

Programme:

V. KOSSOBOKOV (Int. Inst. of Earthquake Prediction Theory ad Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) – Analysis of Earthquake Catalogs.

Analysis of Earthquake Catalogs - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.

Analysis of Earthquake Catalogs - Computer Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.

V. KEILIS-BOROK (International Institute of Earthquake Prediction Theory and Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) – Non-Linear Dynamics & Earthquake Prediction (2 lectures).

O. NOVIKOVA (Int. Inst. of Earthquake Prediction Theory ad Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) – Functions on Earthquake Flow.

Functions on Earthquake Flow - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.

D.K. CHOWDHURY (Purdue Univ., Fort Wayne, Indiana, USA) – Magnitude Spectrum of

Earthquakes.
H. MORITZ (Graz Technical Univ., Austria) – Complexity and Chaos (2 lectures).
D. SORNETTE (Université de Nice Sophia Antipolis, Nice, France) – Multifractal and Wavelet Analysis of Fault Structures: Evidence of Hierarchical Organization of Characteristic Scales.
Self-organized Faults by Repeated Earthquakes: A General Framework.
T. GARIANOVA (Int. Inst. of Earthquake Prediction Theory ad Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) – Software for Analysis of Dynamics of Seismicity.
Analysis of Dynamics of Seismicity - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
A. SOLOVIEV (Int. Inst. of Earthquake Prediction Theory ad Mathematical Geophysics of the Russian Academy of Sciences, Moscow, Russia) – Numerical Simulation of Block Structure Dynamics - I: Description of the Model.
D. SORNETTE – Discrete Scale Invariance - I: Introduction and Experimental Evidence in Rupture, Earthquakes and other Phenomena.
Discrete Scale Invariance - II: Theory.
V. KOSSOBOKOV – Premonitory Activation of Seismicity: The Algorithms "M8" and "Mendocino Scenario".
Numerical Simulation of Block Structure Dynamics - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
Analysis of Dynamics of Seismicity - Computer Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
Numerical Simulation of Block Structure Dynamics - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
V. KEILIS-BOROK – Earthquake Prediction and Earthquake Preparedness.
F. MULARGIA (Università di Bologna, Italy) – Evaluation of Earthquake Prediction.
A. SOLOVIEV – Numerical Simulation of Block Structure Dynamics II – Examples.
F. MULARGIA – Evaluation of Earthquake Prediction.
D. TURCOTTE (Cornell Univ., Ithaca, USA) – Self-Organized Criticality.
Statistics of Seismicity.
A. SOLOVIEV – *Pattern Recognition.*
The Algorithms "M8" and "Mendocino Scenario" - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
D. TURCOTTE – Statistical Mechanics of Earthquakes.
Log-periodic Precursory Seismicity.
The Algorithms "M8" and "Mendocino Scenario" - Computer Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
Pattern Recognition - Exercises: V. Keilis-Borok, T. Garianova, V. Kossobokov, O. Novikova, V. Rozenberg, A. Soloviev.
G. F. PANZA (University of Trieste, Italy) – CN Application to Italy and Microzoning.
B. SHIRMAN (Inst. for Petroleum Res. and Geophysics, Holon, Israel) – Geomagnetic and Electroteluric Anomalies Associated with an Active Strike-slip Fault.
CHEN XIANG XIONG (Fujian Privince Seismological Bureau, P.R. China) – A two-Dimensional Earthquake Fault Model with Fractal Structure Strength Distribution.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	9	
Asia	19	1
Europe	20	12
Indonesia and Oceania	1	
North and Central America	1	3
South America	1	
Total	*51*	*16*
Grand Total	***67***	
Directors and Lecturers	13	
Participants	54	
Countries represented	32	
Person-months	31.84	
Applications received	142	

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Title: WORKSHOP ON DYNAMICS AND STATISTICS OF SECULAR CLIMATE VARIATIONS

Dates: 4 - 8 December.

Co-sponsors: Max-Planck-Institut (Hamburg, Germany), Center for Ocean-Land-Atmosphere Studies (COLA/IGES, Maryland, USA) and WMO/ICSU/IOC World Climate Research Programme (Geneva, Switzerland).

Directors: Professors G. Furlan (University of Trieste and ICTP), A. Navarra (Istituto per lo studio delle metodologie geofisiche ambientali, IMGA, Modena, Italy), J.L. Kinter (COLA/IGES, Maryland, USA), E.K. Schneider (COLA/IGES, Maryland, USA), R. Stouffer (Geophysical Fluid Dynamics Laboratory, Princeton, USA), and J. von Storch (Max-Planck-Institut, Hamburg, Germany).

Report: The aim of the Workshop was to offer an overview of the current observational and theoretical understandings of climate variability on time scales of decades to centuries. The approach, which has been followed since the inception of meteorology and climatology, is based on the construction of theoretical models whose results are then tested by comparison with the limited available observations of the Earth's climate. This has in turn driven the development of rigorous statistical analysis techniques.

These represented the main content of four full days of lectures and seminars. In particular, the following issues were discussed: multi-decade to multi-century integrations using both general circulation models (GCM) and simple conceptual models, the relevance of the description used for studying short-term climate variations to the long-term ones, reviews of regional observations of climatic variability.

The event was attended by a relatively limited number of participants, with the presence of the best experts in the field. This stimulated discussion sessions and favored a fruitful exchange of opinions about the trends in future research. The presence of the "Bora" wind represented an element of interested curiosity for many.

This Workshop was the third of a series of 1995 meetings devoted to the Dynamics of Fluid Earth (the previous ones covered African Drought and Mediterranean Circulation).

G. Furlan

Programme:

INTRODUCTION TO CLIMATE VARIATIONS

J. KINTER (Center For Ocean-Land-Atmosphere Studies, Calverton, MD, USA) – Analyzing Climate Variability with Physical and Statistical Models.

S. LEVITUS (National Oceanic and Atmospheric Administration, Silver Spring, USA) – Interannual to Decadal Variability of the World Oceans.

E. SARACHIK (University of Washington, Seattle, USA) – Climate Variability and the Thermohaline Circulation.

C. COVEY (Lawrence Livermore National Laboratory, Livermore, USA) – Intercomparison of Surface Temperature Variability Simulated by Coupled GCMs.

COUPLED GENERAL CIRCULATION MODELS

S. TETT (Hadley Centre For Climate Prediction and Research, Bracknell, UK) – Global and Regional Variability in a Coupled AOGCM.

J. VON STORCH (Max-Planck-Institut für Meteorologie, Hamburg, Germany) – On the Evolution of Large-Scale Climate Variations.

R. STOUFFER (Princeton University, NJ, USA) – The Role of the Ocean in the Variability of Surface Air Temperature as found in a 1000 Year Integration of a Coupled Atmosphere-Ocean Model.

IDEALIZED CLIMATE MODELS

R. HAARSMA (Royal Netherlands Meteorological Institute, de Bilt, The Netherlands) – Interdecadal Variability in a Simple Climate Model.

R. SARAVANAN (National Center For Atmospheric Research, Boulder, CO, USA) – Idealized Dynamical Models of Very Low Frequency Variability in the Coupled Ocean-Atmosphere System.

G. RAHMSTORF (Universität Kiel, Germany) – Multiple Climate States, Variability, Drift: Results from a Hybrid Coupled Model.

ADVANCED ANALYSIS APPLICATIONS

G. NORTH (Texas A&M University, College Station, TX, USA) – Detection of the Climate Response to the Solar Cycle.

G. BRANSTATOR (National Center For Atmospheric Research, Boulder, CO, USA) – Deducing the Atmospheric Response to External Forcing from Long Control Simulations.

A. NAVARRA (Ist. per lo studio delle metodologie geofisiche ambientali, Modena, Italy) – Statistical Simulation of SST.

ATMOSPHERIC VARIABILITY

S. TIBALDI (Università degli Studi di Bologna, Italy) – Atmospheric Blocking, its Variability and Modelling.

K. MIYAKODA (Ist. per lo studio delle metodologie geofisiche ambientali, Modena, Italy) – Atmospheric Model Parameterizations for Air-Sea Coupled Forecasts of ENSO.

M. LUO (Academia Sinica, Institute of Atmospheric Physics, Beijing, P.R. China, and Istituto di Cosmogeofisica-CNR, Turin, Italy) – The Variation Characteristics of Precipitation Anomalies Over China.

COUPLED GENERAL CIRCULATION MODELS

E. SCHNEIDER (Center For Ocean-Land-Atmosphere Studies, Calverton, MD, USA) – Understanding Secular Climate Variability in a GCM.

V. MEHTA (N.A.S.A. - Goddard Space Flight Center, Greenbelt, USA) – Decadal-Multidecadal Tropical Climate Variability.

V. KHARIN (Max-Planck-Institut für Meteorologie, Hamburg, Germany) – Analysis of Variability in a 1200-Year Integration Obtained with a Coupled Atmosphere/Ocean General Circulation Model.

REGIONAL CLIMATE VARIATIONS

V. BARROS (Universidad de Buenos Aires, Argentina) – Recent Precipitation Trends in Southern South America to the East of the Andes: an Indication of a Mode of Climatic Variability.

M. TOUNKARA (Direction Nationale de Météorologie, Conakry, Guinea) – Statistics Analysis for Climate Variation in Guinea.

K.S. ESSAY (Atomic Energy Authority, Cairo, Egypt) – Irregularity of Climatic Variability.

L. CHANDRAPALA (Department of Meteorology, Colombo, Sri Lanka) – Long-Term Trends of Rainfall and Temperature in Sri Lanka.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia	4	
Europe	1	11
North and Central America	1	10
South America	1	
Total	*9*	*21*
Grand Total	***30***	
Directors and Lecturers	18	
Participants	12	
Countries represented	13	
Person-months	6.20	
Applications received	63	

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PHYSICS OF THE LIVING STATE

Title: SEMINARS IN LIFE SCIENCES

Dates: Throughout the year

Organizer: Prof J Chela-Flores (Instituto Internacional de Estudios Avanzados, Caracas, Venezuela, and ICTP)

Purpose: This series of seminars brings together Visiting Scientists, Associate Members, and visitors from Federated Institutes in discussions of research topics in biophysics, medical physics, neurophysics, theoretical biology, and other related areas in the life sciences

Programme:

I SIMON (Hungarian Academy of Sciences, Budapest, Hungary) – Independence divergence-generated binary trees of amino acids

E AHMED (Mansoura University, Egypt) – A model for a tumor interacting with the immune system

A BAKASOV (Laboratorium fur Physikalische Chemie, ETH, Zurich, Switzerland) – *Ab initio calculation of molecular energies including parity violating interactions*

S AKYUZ (Istanbul University, Turkey) – Conformational possibilities of peptide T, a competitor of the human immunodeficiency virus

F DE LA FUENTE (Centro Nacional de Investigaciones Cientificas, La Habana, Cuba) – Development of a single photon bone densitometer

O DE LA LUZ ROJAS (Instituto Tecnologico de Celaya, Guanajuato, Mexico) – Langevin dynamics of *Escherichia coli* enterotoxins role of disulfide bridges (with a video illustration)

A Y SHIEKH (ICTP) – The thinking machine

I U ASUZU (Univ of Nigeria, Nsukka) – Drugs from plants

O CARELSE (University of Zimbabwe, Harare) – The polymerase chain reaction — Techniques and applications

YAN SHIWEI (China Institute of Atomic Energy, Beijing) – Nonlinear model of DNA molecules

The Seminars were held by scientists visiting ICTP under different schemes and participating in other activities

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Title: FIRST ANTONIO BORSELLINO COLLEGE ON NEUROPHYSICS including SYMPOSIUM ON DYNAMIC PROPERTIES OF RECEPTIVE FIELDS AND PLASTICITY OF PROCESSING SYSTEMS (17 - 19 May)

Dates: 15 May - 9 June

Directors: Professors G Geiger (Massachusetts Institute of Technology, Cambridge, Mass , USA), J Kaas (Vanderbilt University, Nashville, TN, USA), and O Siddiqi (Tata Institute of Fundamental Research, Bombay, India) Local organizer J Chela-Flores (ICTP)

Report: The late Professor Antonio Borsellino, a founding Director of the ICTP Colleges on Neurophysics, was honoured this year by two events in Italy

From 3 - 12 May the Ettore Majorana Centre in Erice held a "Memorial Course" for Borsellino, who founded the Ettore Majorana International School of Biophysics in 1969 This year's Erice event was directed by Professors Franco Conti and Vincent Torre

At the ICTP we held the First Antonio Borsellino College on Neurophysics from 15 May - 9 June. It was directed by Professors Gadi Geiger, Jon Kaas and Obaid Siddiqi. The subject of the College was: "The Processing and Use of Sensory Information in Biological Systems". In the opening ceremony, chaired by Professor Luciano Bertocchi, Deputy Director of the ICTP, the following text was read, which was written by Professor Paolo Budinich:

"I met Nino Borsellino at the Scuola Normale in Pisa in 1934. He was coming from Reggio Calabria and I from Trieste. This did not prevent us from becoming friends. For me that was the closest friendship of my life. Since the beginning in Pisa we had tremendous discussions frequently ending in fights at the end of the night when the first light of day was entering through the window! Borsellino accused me of being a mystic; I accused him of being blinded by abstract logic. In Pisa he graduated in Theoretical Physics; he was the favourite student of Giulio Racah. However Racah had to emigrate as a Jew. Later Borsellino devoted himself to biophysics for which he was a pioneer in Italy. When we created SISSA it was quite natural for me to try to have him in the first nucleus of professors, together with Ambrosetti for Mathematics and Dallaporta for Astrophysics. The idea was that biophysics and biological sciences were fundamental for the future of SISSA and he was the best professor we could have in Italy. I personally felt it necessary to have Borsellino — a close friend of mine whom I trusted both as a man and as a scientist without reserve — with me in that new adventure. Now the biological branch, extending also to cognitive sciences, is flourishing in SISSA. It is good to remember that a lot of these successes are due to Antonio Borsellino."

A message was read from the Italian Minister for University and Scientific Research and Technology, Professor Giorgio Salvini: "I congratulate you for your important initiative: "Antonio Borsellino College on Neurophysics". It is a pleasure for me to send my personal greetings to all participants, wishing the conference the deserved success.

With my best personal regards,

Giorgio Salvini"

The College had 23 lecturers coming from Brazil, Germany, India, Israel, Italy, UK, and USA. The topics covered included: visual processing of space and motion; auditory coding; taste and olfaction; coding in somatosensory systems; attention, memory, learning, recognition and reading — all of these topics were considered in human and animal models; motor control systems; theoretical considerations, neural models and their application to understanding neuronal processing; development and plasticity; clinical studies and brain imaging.

The 52 participants came from the following countries: Argentina, Brazil, Colombia, Cuba, Egypt, Germany, Hungary, India, Iran, Israel, Nigeria, Pakistan, Peru, P.R. China, Romania, Sierra Leone, Turkey, Ukraine, USA and Vietnam. These participants came from departments and institutes of: Audiology and Speech Therapy School; Biochemistry; Bioelectronics; Biology; Biomedical Engineering; Biophysics; Children's Hospitals; Electrical and Electronic Engineering; Mathematics; Medicine and Psychology; Molecular Biophysics; National Research Centres; Neurological Surgery; Physics and Psychology.

The format of the College was very successful. The subject matter was covered in 72 lectures. Within the framework of the College, a three-day mini-symposium was inserted on the "Dynamic Properties of Receptive Fields and Plasticity of Processing Systems" in which this topic was covered in depth in 14 lectures. The topics covered included: dynamic features of visual processing; adult plasticity; plasticity in the auditory, visual and somatosensory systems; models of adult plasticity; "learning" in somatosensory systems; glutamate receptors and synaptic genesis; activity dependent regulation of plasticity; NMDA receptors and nitric oxide in the development of visual connections; visual activity and cortical development; development of cortical connectivity; observed plasticities which are difficult to account. This aspect is considered by us as so important that we feel it should be part of future Colleges. Another important aspect of this activity was a set of discussion sessions at the end of the day in which, besides discussions in detail of the day's lectures, participants delivered 15 specialized seminars on a variety of topics closely related to the main theme of the College.

In addition, a session of posters received 9 contributions from the participants.

Recommendations — The very high level in the First Antonio Borsellino College on Neurophysics, achieved by the dedication and initiatives of its Directors, should be continued in 1997. For logistics reasons we suggest once again the late Spring for the next College.

We have also observed that the possibility of having direct oral and poster presentations by well-qualified participants was an important aspect of the College and was well appreciated. This

aspect should also represent a component of future activities.

As mentioned above, the Mini-symposium is considered one of the key factors for the success of the College and this format should be preserved in the future.

Finally, we have noticed that the ICTP mailing lists are still oriented too much towards the physical sciences and not as much towards the life sciences, particularly psychology and neurology departments. The preliminary life science mailing lists should be improved.

Julian Chela-Flores

Statistical Details — College

Scientists from	***Dev. C.***	***Adv. C.***
Africa	4	
Asia	13	1
Europe	10	17
North and Central America	3	17
South America	11	
Total	*41*	*35*
Grand Total	***76***	
Directors and Lecturers	24	
Participants	52	
Countries represented	23	
Person-months	50.34	
Applications received	130	

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Statistical Details — Symposium

Scientists from	***Dev. C.***	***Adv. C.***
Africa	4	
Asia	12	
Europe	7	2
North and Central America	1	10
South America	11	
Total	*35*	*12*
Grand Total	***47***	
Directors and Lecturers	8	
Participants	39	
Countries represented	18	
Person-months	4.45	
Applications received	47	

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Title: WORKSHOP ON QUANTITATIVE BIOPHYSICS AT THE MOLECULAR AND MACROMOLECULAR SCALES

Dates: 29 June - 7 July.

Co-sponsors: European Commission (Brussels, Belgium).

Directors: Professors J.A. Krumhansl (Cornell University, Ithaca, USA), S.M. Lindsay (Arizona State University, Tempe, USA), and M. Muthukumar (Univesity of Massachusetts, Amherst, USA).

Purpose: To develop a basic familiarization on the part of students in physics with the main basics of biological molecules.

Programme:

J.A. KRUMHANSL (University of Massachusetts, Amherst, USA) – **Introduction to molecular biology for physicists.**

Comparison between viewpoints in biomolecular science and condensed matter physics. Scales and structural hierarchy from biomolecules to cells. Principal chemical building blocks of proteins and nucleic acids. Introduction to conformation concepts and issues.

A.E. GARCIA (Los Alamos National Laboratory, USA) – **Methods for studying biomolecular dynamics.**

Molecular physics, interactions, model potentials for biomolecules, shape and dynamics. Introduction to simulations and interpretation. Important experimental techniques for biomolecule diagnostics-overview. Illustrative results on common biomolecules.

M. MUTHUKUMAR (University of Massachusetts, Amherst, USA) – **Overview of polymer physics.**

Current polymer physics. Statistical mechanics of polymers; classical theory of helix-coil transitions. Comparisons between biopolymers and technological polymers. Useful experimental techniques.

T. DAUXOIS (Ecole Normale Supérieure, Lyon, France) – **Overview of nonlinear physics.**

Developments in nonlinear science (solitary excitations but no chaos). Summary and status of some model attempts to interpret biomolecular dynamics in terms of nonlinear phenomena, at an introductory level.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	3	
Asia	10	1
Europe	15	9
North and Central America	1	8
South America	3	
Total	*32*	*18*
Grand Total	***50***	
Directors and Lecturers	10	
Participants	40	
Countries represented	27	
Person-months	13.23	
Applications received	120	

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Title: ADRIATICO RESEARCH CONFERENCE ON THEORETICAL MODELS IN BIOLOGICAL SYSTEMS

Dates: 3 - 7 July.

Co-sponsors: European Commission (Brussels, Belgium) and International School for Advanced Studies (SISSA, Trieste, Italy).

Directors: Professors J.A. Krumhansl (University of Massachusetts, Amherst), S.M. Lindsay (Arizona State University, Tempe, USA), and M. Muthukumar (University of Massachusetts, Amherst, USA).

Purpose: To bring together biophysicists working in macromolecules with the aim to understand models with biological meaning.

Programme:

J.A. KRUMHANSL (University of Massachusetts, Amherst, USA) – Overview: Bridges in Molecular Biophysics.

N. GO (Kyoto University, Japan) – Harmonicity and Anharmonicity in Protein Dynamics.

A.E. GARCIA (Los Alamos National Laboratory, USA) – Simulations of the Dynamics of Crambin.

J. ONUCHIC (University of California, San Diego, USA) – Protein Folding Simulations.

J.A. KRUMHANSL (University of Massachusetts, Amherst, USA) – Generic Nonlinear Phenomena #1: Debye-Waller Factors; Pattern Development.

R. LAVERY (Institut de Biologie Physico-Chimique, Paris, France) – Conformation Changes in Nucleic Biomolecules: Simulations.

N. KALLENBACH (New York University, USA) – Protein Stability and Folding.

H. FRAUENFELDER (Los Alamos National Laboratory, USA) – Ligand BIndings to Heme Proteins.

R. CHAMBERLIN (Arizona State University, Tempe, USA) – Relaxation Concepts in Complex Condensed Matter.

M. MUTHUKUMAR (University of Massachusetts, Amherst, USA) – Central Concepts and Methods in Polymer Physics.

T. DAUXOIS (Ecole Normale Supérieure, Lyon, France) – Generic Nonlinear Phenomena #2: Solitary Excitations.

Participants' Contributions.

Panels: Biomolecular Conformation Transformations. Polymers Generally vs. Bioploymers.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	3	
Asia	11	1
Europe	19	13
North and Central America	1	8
South America	4	
Total	*38*	*22*
Grand Total	***60***	
Directors and Lecturers	10	
Participants	50	
Countries represented	31	
Person-months	8.52	
Applications received	76	

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Title: TRIESTE CONFERENCE ON CHEMICAL EVOLUTION, IV: PHYSICS OF THE ORIGIN AND EVOLUTION OF LIFE, "CYRIL PONNAMPERUMA MEMORIAL"

Dates: 4 - 8 September.

Co-sponsors: International Centre for Genetic Engineering and Biotechnology (ICGEB, Trieste, Italy), UNESCO, and Université Paris 12 - Val de Marne (France).

Advisory Committee: Mohindra S. Chadha (India), J. Mayo Greenberg (The Netherlands), Mikhail S. Kritsky (Russia), Alexandra J. MacDermott (UK), Alicia Negrón-Mendoza (Mexico), Juan Oró (USA), Tairo Oshima (Japan), Manfred Schidlowski (Germany), Peter Schuster (Germany), and Wang Wenqing (China).

Directors: Professors J. Chela-Flores (ICTP, Trieste, IDEA, Caracas, and DIAS Dublin) and F. Raulin (University of Paris 12, France).

Report: There were 57 registered participants from a world-wide distribution with significant representations from China, France, Japan, Mexico, Russia and USA. Many other Third World and industrialised nations were represented. Members closely related with the activities of the key agencies that are concerned with the general subject matter that was discussed were also present at the Fourth Trieste Conference, a fitting tribute to Cyril Ponnamperuma to whom this event was dedicated: NASA, the European Space Agency (ESA), the nucleus of the RMT group from Japan (cf. below), as well as scientists from the Babakin Engineering Centre and Lebedev Institute, Moscow.

Altogether there were 48 talks dealing with the subject matter of the Conference, a session of six contributions on the life and work of Cyril Ponnamperuma, and a poster session in which five posters were presented. A photographic exhibition on the work of Ponnamperuma was organised by Alicia Negrón-Mendoza and Wang Wenqing. The ICTP Library collaborated with a book display, which included copies of all the proceedings of the three previous Trieste Conferences on Chemical Evolution and the Origin of Life. The first two volumes were published by Deepak Publishers, Virginia, USA, while the Third Conference was published by Kluwer Publishers (The Netherlands); the proceedings of the Fourth Conference will also be published by Kluwer.

There were two evening sessions in which the international group which was organised by the suggestion of Ponnamperuma during the Third Trieste Conference met in the present meeting for the first time. The group, known by the name "Return-to-Mars-Together" (RMT) is being led by a group of Japanese scientists, of whom four were now present at Trieste. Their aim is to establish a collaborative effort with the next Planetary Mission aimed to land on Mars. It is expected to be launched in late 1997. In this group biologists are represented. During the Conference two of the key figures of the Russian Mission were present in the company of a scientist from NASA, the agency that was responsible for the first landing in the 1970s.

The main message that comes from the Cyril Ponnamperuma Memorial is that the mature discipline of the origin-of-life studies has gone from the exclusive environment of laboratories of organic chemistry (where some of the pioneers of the subject worked, such as Juan Oró and Sidney Fox who were present at the Trieste meeting) to the hands of space scientists, palaeontologists, geochronologists and biologists. This last group of specialists discussed at length the key topic of the origin of the nucleated cell, since this topic finds itself exactly half way in the range of topics discussed in the modern approach to the subject adopted at the Conference. These subjects go from chemical evolution of the biomolecules of life, to the search for extraterrestrial intelligence (SETI), a subject pioneered by Frank Drake, present throughout the Trieste meeting. The importance of eukaryogenesis may be underlined by the fact that the only intelligence that is known to date consists of (multicellular) eukaryotic organisms, whose presence was triggered by the Earth atmospheric evolution. About two billion years ago our planet acquired significant levels of oxygen, which permitted the onset of eukaryogenesis. The recent discovery of the presence of oxygen in the Solar System (in the atmosphere of Europa,

the Jupiter satellite) adds considerable interest to the biological approach to the origin of life.

Conclusions — The success of the Conference was also due in part to the appreciation of the international scientific community for the Trieste events; this is demonstrated by the fact that a major part of the expenses (not covered by the sponsors) was covered partially or totally by many high level visitors from many institutions who were eager to present their results in this regular event in the international scientific calendar.

A set of valuable recommendations regarding the series of four conferences on Chemical Evolution was provided by the members of the Advisory Committee who were present at the meeting.

Julian Chela-Flores

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	4	
Asia	6	7
Europe	7	16
North and Central America	4	11
South America	1	
International Organizations		1
Total	*22*	*35*
Grand Total	***57***	
Directors and Lecturers	45	
Participants	12	
Countries represented	21	
Int'l Organizations represented	1	
Person-months	13.55	

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Title: SECOND SCHOOL IN RADIOPHYSICS (Diagnostic Radiology)

Dates: 23 - 27 October.

Co-sponsors: European Federation of Organisations for Medical Physics (EFOMP), International Organization for Medical Physics (IOMP), Institution of Physics and Engineering in Medicine and Biology (IPEMB), and French Medical Physics Association.

Directors: Professors A.M. Benini (International Atomic Energy Agency, Vienna, Austria), L. Bertocchi (ICTP), J. Chela-Flores (Local organizer, Instituto Internacional de Estudios Avanzados, Caracas, Venezuela, and ICTP), P. Dendy (European Federation of Organisations for Medical Physics, Cambridge, UK), K.A. Jessen (Århus Kommunehospital, Denmark), F. Milano (University of Florence, Italy), and A. Noel (Centre Alexis Vautrin, Vandœuvre-Les-Nancy, France).

Purpose: To provide the participants with up-to-date training in radiology which is essential for improved standards in clinical practice, with special emphasis in radiation protection, imaging techniques and dosimetry.

Report: This event was jointly sponsored by the International Centre for Theoretical Physics and the European Federation of Organisations for Medical Physics. Additional financial support was granted by the International Organisation for Medical Physics, the Institution of

Physics and Engineering in Medicine and Biology and the French Medical Physics Association.

The School was directed by A.M. Benini, L. Bertocchi, P. Dendy, K.A. Jessen, F. Milano and A. Noel. In addition there were 9 lecturers. The staff came from 6 countries from the European Union (Austria, Belgium, Denmark, France, Italy and the U.K.). The 45 participants came from 5 countries from the European Union (Greece, Ireland, Italy, Spain and the U.K.), from one European country outside the European Union (Switzerland), 12 East European countries (Bulgaria, Croatia, Czech Republic, Estonia, Hungary, Lithuania, Poland, Romania, Russia, Slovak Republic, Slovenia and Ukraine), two African countries (Nigeria and Zimbabwe), one from Asia (Bangladesh), one from Turkey and one from Israel.

Altogether there were 26 lectures, 4 workshops, 6 hours of practical lessons, one round-table discussion. All participants were provided with a full set of lecture notes.

The Second School on Radiophysics (Diagnostic Radiology) follows a sequence of EFOMP-sponsored summer schools for qualified experts in radiation physics which took place in 1992 (Dublin) in Nuclear Medicine, 1992 (Seville) in Radiotherapy, and 1994 (Nancy, France) in Diagnostic Radiology. The present Trieste School follows closely the successful Nancy School.

All participants were issued with a questionnaire for follow-up evaluation of the School. Analysis of their responses will be provided at a later date.

This activity continues to represent a valuable part of the ICTP programme of Physics of the Living State and should be continued.

Julian Chela-Flores

Programme:

A. BENINI (IAEA, Vienna, Austria) – Introductory 1: International framework for radiation protection.

P. DENDY (EFOMP, UK) – Introductory 2: Approach of the EFOMP Education Training and Professional Committee.

F. MILANO (EFOMP and Università di Firenze, Italy) – Basic physics of images - 1.

R. VAN LOON (Vrije Universiteit Brussels, Belgium) – Basic physics of images - 2.

R. PADOVANI (Ospedale Santa Maria della Misericordia, Udine, Italy) – Radiation Protection - 1: ICRP basic concepts of radiation protection. The biological basis of deterministic and stochastic effects of radiation-dose limits for deterministic effects.

P. DENDY – Radiation Protection - 2: Risk estimates for stochastic effects of radiation and the impact of ICRP 1990 recommendations.

R. PADOVANI – Radiation Protection - 3: Protection of the worker and general public, dose limits and alternative approaches for patients.

Workshops.

A. NOEL (EFOMP, France) – Imaging modalities - 1: Film screen combination.

M. DE DENARO (Servizio di Fisica Sanitaria, Unità Sanitaria Locale, Trieste, Italy) – Imaging modalities - 2: Digital imaging.

R. VAN LOON – Imaging modalities - 3: Fluoroscopic imaging.

A. BENINI – QA in Radiology - 1: implementation of QA in radiology departments and the role of the physicist.

F. DE GUARRINI (Servizio di Fisica Sanitaria, Unità Sanitaria Locale, Trieste, Italy) – QA in Radiology - 2: Routine X-ray equipment — tubes and generators, films and screens, automatic exposure control.

R. VAN LOON – QA in Radiology - 3: Image intensifier/TV systems.

Workshops.

G. CONTENTO (CYBERQUAL S.r.l., Gorizia, Italy) – Dose measurements and dose calculations - 1: Choice of monitor — ionisation chamber, TLD semiconductor, range of usefulness, calibration, traceability.

R. VAN LOON – Dose measurements and dose calculations - 2: Calculation of organ doses and effective doses: 1. Measurements including concepts of entrance and exit dose, dose area product meters; 2. Calculation, including Monte Carlo methods.

P. DENDY – Dose measurements and dose calculations - 3: Doses involved in various X-ray procedures (dose surveys, reference doses, CEC trials).

Practical Sessions at Cattinara Hospital (Trieste):
R. VIDIMARI (Servizio di Fisica Sanitaria, Unità Sanitaria Locale, Trieste, Italy) – Quality control in mammography.
F. DE GUARRINI – Image intensifier/TV systems and dark room.
M. DE DENARO – CT quality control.
L. BENINI (Servizio Multizonale Area Fisica, Pesaro, Italy) – Quality control in X-ray equipment.

A. NOEL – Special Techniques - 1: Mammography.
K. JESSEN (EFOMP, Denmark) – Special Techniques - 2: Computed tomography.
A. NOEL – QA in Radiology - 4: Quality control of film processing.
C. MACCIA (CAATS, Bourg la Reine, France) – QA in Radiology - 5: Mammography.
K. JESSEN – QA in Radiology - 6: Image quality criteria in CT.

Practical sessions at Cattinara Hospital (Trieste):
P. DENDY – Special techniques - 3: Good practice in dental radiology — An example of cost benefit analysis.
E. CASTELLI (INFN, Università di Trieste, Italy) – Special techniques - 4: Application of synchrotron light in mammography.
A. BENINI – Dose measurements and dose calculations - 4: Results of an IAEA research programme on dose measurement.

Round Table Discussion on current radiation protection practice in Europe and likely developments — Contributions from IAEA, France, Italy, UK, EFOMP and others.

P. DENDY – Dose measurements and dose calculations - 5: Review of the workshop on dose assessment in patients and other practical calculations.
C. MACCIA and R. PADOVANI – Radiation protection - 5: CEC programme on image quality criteria.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	3	
Asia	1	1
Europe	23	29
South America	1	
International Organizations		2
Total	*28*	*32*
Grand Total	***60***	
Directors and Lecturers	16	
Participants	44	
Countries represented	27	
Int'l Organizations represented	2	
Person-months	14.52	
Applications received	107	

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APPLIED PHYSICS

Title: MICROPROCESSOR LABORATORY

Dates: All year.

Head: Prof. A.A. Colavita (ICTP).

The activities of the ICTP–INFN (Italian National Institute for Nuclear Physics) Microprocessor Laboratory, sponsored by the UNU (United Nations University), were divided along the following lines:

1) Research and development projects.
2) Training activities.

1) Research and Development Projects

The purpose of the following projects is to train scientists from developing countries through research. Since projects are real and important, a perfect environment is created to sharpen the problem-solving abilities of the participating scientists. The funds required for research are obtained from funding agencies, other than ICTP, after an open competition with other institutions.

Several long-term scientists are participating in the projects: 2 from Cuba, 2 from China, 2 from Italy, 1 from Argentina, 2 from Zimbabwe, 1 from Nigeria and 1 from Romania.

Ongoing projects

1.1) GLAST

The Microprocessor Laboratory is a founding member of the GLAST (Gamma-ray Large Space Telescope) collaboration (see *Science*, 271, p. 142, 1996). The GLAST collaboration was formed with the purpose of submitting to NASA a complete proposal for a large satellite instrument.

GLAST was presented to NASA during September 1994 and was approved during February 1995 after a severe peer review. Detailed scientific and technical literature is available for GLAST. The project advances will be re-evaluated by NASA at the end of 1996 or beginning of 1997. If approved further, the project will extend until 2002-5, the date of the probable launch of the instrument.

The Microprocessor Laboratory's contribution to the collaborations is its pioneering work done in the development of gamma-ray telescopes using silicon strip technology. We remind that ARGO, the first-ever proposal of the next generation telescopes, was developed at Trieste by INFN and ICTP.

Other members of the collaboration are: Stanford University, University of Chicago, Naval Research Lab., University of California at Santa Cruz, Caltech and California State University at Sonora.

1.2) HASP

This is the first of several projects executed within the joint UNU-ICTP Programme.

The Laboratory designed, built and successfully tested a data acquisition computer created for stand-alone operation. The project was needed to control a solarimeter for field applications. It needed to be low cost, low power and rugged. Using state-of-the-art components, the computer was developed in record time achieving operational status two months after the project started. A complete report is available describing the hardware and software of the system.

1.3) MEDUSA

This project is funded by INFN. The project must be executed during 1995-1997. It consists in the development of a complete prototype silicon detector plane for space applications.

The most remarkable result obtained so far is the design and test of a complete pre-amplifier that uses only 95 microwatts per data channel. This chip allowed the submission of GLAST to NASA since the power budget for the full instrument had to be below 1 kw to make the proposal

for the satellite feasible. Full documentation is available for the 8 and 32 channel prototype chips.

1.4) DIGITAL MAMMOGRAPHY

This is the second of several projects executed within the joint UNU-ICTP Programme.

The purpose of the project is to apply the experience gained by the Laboratory, with regard to silicon detectors and the design of massive integrated data acquisition systems, to the design of an X-ray detecting plane to replace the usual photographic plate. The objective is to obtain a better picture mammogram since the pixel detector under development will be linear with respect to the number of photons and almost noise free. A full detector plane will have close to 1 million pixels.

The project can be considered fully manned only from December 1995.

Research work is now proceeding very fast and some results, probably accepted for publications, will be available during 1996.

It is important to note that, attracted by the importance and novelty of the approach, a team composed of Dr. Magali Estrada and Dr. Antonio Cerdeira are working in Mexico developing a version of our pixel silicon detector using amorphous silicon instead of crystalline silicon.

The silicon detector design and the pre-amplifiers will be delivered for fabrication during January or February 1996 at the latest. Some characterization measurements will be ready in about six months' time.

Future projects

To obtain funds for research the Laboratory must work preparing projects that are presented to funding agencies for review and probable approval. During 1995 we worked and presented the following projects:

1.5) GRSST

GRSST (Gamma-Ray Small Space Telescope) was presented to the Department of Energy of the United States in December 1995. It is a small version of GLAST that could be flown with a smaller launcher. The collaborating institutions are the same as for GLAST. A decision is expected during the first half of 1996. The project could expand for four to six years.

1.6) GRABB

GRABB (Gamma Ray Burst Buoys) was presented to the Italian Space Agency (ASI) during November 1996 jointly with Alenia, the mayor Italian airspace company. A decision is expected during 1996. The project consist of the design and construction of at least four small satellites to detect the position of gamma ray bursters. The nature of gamma-ray bursters is of foremost importance to astrophysics.

Each satellite will have radiation detectors in order to detect, by triangulation, the direction of the incoming radiation. Using more than one satellite we could also apply time-of-arrival to further determine the position of the burster. This last method requires very accurate timing. We would use the Global Positioning System of satellites as a very precise timing network.

2) Training Activities

2.1) First Bolivian Course on Computerized Data Acquisition

The Laboratory held the First Bolivian Course on Computerized Data Acquisition from 13 to 24 February 1995 in La Paz, Bolivia. The course was organized using funds provided by UNU and with the collaboration of Centro Internacional de Física de Santa Fe de Bogotá, Colombia. More than 30 scientist from the region participated in the course.

The Laboratory personnel is now working on the organization and technical preparation of the following coming events:

- First Regional Course on Advanced VLSI Design Techniques, to be held in Havana, Cuba, from 5 February to 1 March 1996.
- ICTP-INFN-UNU-Microprocessor Laboratory: Fourth Course on Basic VLSI Design Techniques, 18 November - 13 December 1996.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Asia	3	
Europe		2
North and Central America	1	
South America	3	
International Organizations		1
Total	*7*	*3*
Grand Total	***1 0***	
Countries represented	7	
Int'l Organizations represented	1	
Person-months	26.03	
Applications received	30	

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Title: LABORATORY FOR LASERS AND OPTICAL FIBRES

Dates: All year.

Head: Prof. G. Denardo (ICTP).

The laboratory offers training and research opportunities in the fields of lasers, optics and optical fibres. ICTP training colleges are regularly supported by the experimental sessions held at the laboratory.

The flexibility of the laboratory structure allows to carry out several research activities and to train many visiting scientists, according to their different interests, on the use of some devices and set-ups. A greater emphasis is given to the development of optical methods and techniques related to the field of environmental research. Another field of interest of the laboratory is the application of lasers in modern technologies such as optical fibres for telecommunications. Some of these activities have been initiated and carried out in close collaboration with external industrial and research institutions, like the Sincrotrone Trieste and Pirelli Cavi S.p.A., Milan. On fibre optics, the laboratory was involved in a long-term joint project with the Federal Institute for Quantum Electronics, ETH-Zurich, Switzerland.

The Laser Section

Several gas, solid state, semiconductor and dye lasers are at the disposal of trainees and researchers. Nonlinear crystals for frequency conversion are available as well. These sources are used for characterization measurements, to carry out research in basic laser physics, and some experiments for laser applications in industrial and environmental problems. The main experimental activities during the 1995 are listed below:

- Experiments on photoinduced Bragg-grating generation in Ge-doped optical fibres were carried out in collaboration with the Pirelli Cavi's research group in Milan. Reflective structures have been produced in both passive and active (Er-doped) single mode fibres.
- Studies of the processes triggered by UV irradiation of Ge-doped fibres revealed the existence of fast transient refraction index and absorbtion changes.
- Experimental setups for diode laser pumping of solid state laser crystals and external cavity tunable laser diodes have been built. In particular, characterization studies of the lasing and nonlinear optical properties of a promising laser material (Nd:KGW) are in progress.
- Continuing the work on generation of 589 nm laser light by intracavity frequency mixing in Nd:YAG laser, CW generation of such radiation was obtained in both lamp- and diode-pumped system. This wavelength is important, since it coincides with the Na resonance absorption line and is widely used for studies of the dynamics of the stratosphere.

The Optical Fibre Section

The laboratory offers a number of hands-on activities on pre-set experiments. The aim is to offer the opportunity to use instruments that appear in the day-to-day practice of the physicists and engineers who use optical fibres, mainly for telecommunications.

- A long-term joint development project with the Federal Institute for Quantum Electronics, ETH-Zurich, Switzerland was hosted in this section. As a result of this activity a prototype of an all-optical Local Area Network (LAN) has been developed.
- In connection with the LAN project, the work on an algorithm for optimal optical orthogonal code design has been completed.

The Optics Section

Set-ups to perform training on interferometry, photon counting, holography, Fourier-optics and (most recently) optical phase conjugation are available in the laboratory. A number of educational kits are used for demonstrations on the basic laws of optics and on the principles of modern optical devices. A video library on optical physics and technologies and a set of computer software on simulation, analysis and design of complex optical configurations are at the disposal of the researchers and participants of colleges.

- Detection of ultrasonic waves is a promising techniques for studying the internal defects of solid materials. A method for obtaining interferometric signals from bulk ultrasonic waves by measuring the microdisplacement of rough surfaces has been proposed and experimentally demonstrated. The method is based on self-pumped phase conjugation in $BaTiO_3$ crystal.
- A new software for numerical modelling of soliton propagation in nonlinear media was developed. The program is suitable both for educational and research purposes.

Publications

M.B. Danailov and P. Apai, UV-induced transmission frustration in optical fibres, *Appl. Phys. Lett.* **67** (1995), p. 3393.

M.B. Danailov, T. Gasmi and P. Apai, Transient refraction index changes in UV-induced optical fibres, submitted to *Electron. Lett.*, 1995.

R. Hrovatin, A. Kobe and M.B. Danailov, Self-pumped phase conjugation in interferometric detection of laser induced ultrasonic waves on rough surfaces, submitted to *Appl. Phys. Lett.*, 1995.

N. Ridi, F. Vaninetti, M.B. Danailov and P. Apai, Diffraction gratings in fibres (in Italian), Proceedings Fotonica '95, Sorrento, Italy (AEI-Italy, 1995), p. 365.

H.F. Ahmad and C. Argon, Optical Orthogonal Code Design Using Difference Sets and Projective Geometry, *Optics Commun.* **118** (1995), p. 905.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	6	
Asia	2	
Europe	6	2
South America	1	
Total	*15*	*2*
Grand Total	***17***	
Countries represented	15	
Person-months	40.35	

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Title: LAMP (Laser, Atomic and Molecular Physics) SEMINARS

Dates: Throughout the year.

Organizer: Professor G. Denardo (ICTP).

Purpose: To discuss the theoretical and experimental physics of lasers, spectroscopy and optical fibres.

Seminars:

M. MOHAN (Delhi University, New Delhi, India) – Collisional excitation of highly changed ions, useful in astrophysics and fusion plasmas.

M.A. GONDAL (King Fahd University of Petroleum and Minerals, Dhahran, Saudi Arabia) – Collisional energy transfer in laser-pumped metastable Ca atoms.

S. AKYÜZ (Istanbul University, Turkey) – Theoretical conformational analysis of biological active mactomolecules.

A.-S.F. OBADA (Al-Azhar University, Cairo, Egypt) – Even binomial states: Introduction and properties.

D.B. HOROSHKO (Academy of Sciences of Belarus, Minsk, Belarus) – Sub-Poissonian photocount statistics in the presence of feedback.

R. AYDIN (Middle East Technical University, Ankara, Turkey) – Observation of large displacements and production of optical elements by holographic interferometry.

O.A. RABI (Laboratoire de Physique des Lasers, Université Paris Nord, France) – Non-linear 'selective' reflection: A way for probing the transient response of atoms desorbing from a surface.

R.O. BARRACHINA (Centro Atómico Bariloche and Instituto Balseiro, Bariloche, Argentina) – Rainbow and glory effects in atomic collisions.

M.T. ROCCO GIRALDI (CEFET Parana', Curitiba, Brazil) – Tunable Er-doped fiber ring laser.

A.S. NDAO (Department of Physics, University C.A.D., Dakar, Senegal) – Resonant photoionization of helium and helium-like systems near n=4 threshold of the reduced ion.

The Seminars were held by scientists visiting ICTP under different schemes and participating in other activities.

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Title: HIGH TEMPERATURE SUPERCONDUCTIVITY LABORATORY

Dates: All year.

Head: Prof. F.C. Matacotta (Istituto di spettroscopia molecolare, ISM, Bologna, Italy, and ICTP).

Research

The group continued to work on the two research lines that were initially started in 1991-92. In particular, over last year, our interest definitely moved from superconductivity to more general aspects of oxide materials science. Most of the work was carried out in very close collaboration with a restricted group of laboratories. This became necessary as the number of experimental techniques necessary to continue our research at their high quality level has gone well beyond the present limitations of the ICTP lab.

1) Synthesis of complex oxides with anionic layers Exploiting our original technique to grow millimeter size single crystals of a number of different barium copper oxycarbonates and oxyhalides, our structural studies on such materials have led to the understanding of quite fundamental processes occurring in such materials In particular, we have found that copper-oxygen structural blocks (like corner- and edge-sharing chains) can be reversibly replaced by complex anions like carbonate groups The copper/anion ratio follows typical thermodynamic equilibrium curves that depend on temperature and CO_2 and O_2 partial pressures In the case of pure barium copper oxycarbonates, there is a continuous series of compounds going from $BaCO_3$ to $Ba(CuO_x)_{0.6}(CO_3)_{0.4}$ The increase of the copper content, induced by temperature, drives several structural transformations from the aragonite-like structure (simple hexagonal packing) to the layered perovskite (cubic close packing) A very striking characteristic of these materials is the coexistence of ordered and disordered sublattices

2) High T_c thin films In 1994 we have finally completed our optimization work on the pulsed electron beam deposition system The quality of our superconducting films is equivalent to the best available samples Since we could not afford the costs of their full cryogenic characterization necessary to develop superconducting devices like switches, microwave filters and SQUIDS, we have focused our attention on problems related to film growth modalities The extreme reliability of our deposition technique has allowed the systematic study of the film microstructure as function of deposition parameters like growth temperature, adatoms rate and film thickness

Collaborations

Istituto di spettroscopia molecolare del Consiglio nazionale delle ricerche (CNR-ISM), Bologna, Italy
Istituto di chimica e tecnologia dei materiali e componenti per l'elettronica del Consiglio nazionale delle ricerche (CNR-LAMEL), Bologna, Italy
CNR-Centre for X-ray diffractometry, Parma, Italy
Dept of Materials Engineering, University of Trento, Italy
Laboratory of Advanced Technologies for Surfaces and Catalysis of the University Network for the Physics of Matter (INFM-TASC Laboratory), Trieste, Italy
Institut Laue-Langevin, Grenoble, France
National Chemical Laboratories, Pune, India
Centro Atomico Bariloche, Bariloche, Argentina
Dept of Physics, University of Kinshasa, Zaire
Institute for Materials and Reagents, University of La Habana, Cuba
Institute of Plasma Physics KFK Karlsruhe, Germany

Scientific personnel

Long term scientists

- Valentin I Dediu, Institute of Applied Physics, Kishinev (Moldavia), 1 May '93 - 31 Oct '96
- Petr Nozar, Charles University, Prague (Czech Rep), 1 Jan '92 - 31 Dec '96

Short term scientists

- P Ganguly, National Chemical Lab, Pune (India), 7 June '95 - 22 June '95
- Ahmed Kursumovic, "Energoinvest" Institute for Materials, Sarajevo (Rep of Bosnia-Herzegovina), 13 March '95 - 18 Aug '95

Trainees

- Stanislav Danis, Institute of Physics, Academy of Sciences, Prague (Czech Republic), 28 Dec '94 - 26 Jan '95
- Luis Eduardo Flores Fernandez, Universidad de La Habana (Cuba), 15 July '95 - 23 Aug '95
- Juan Lopez Linares, Universidad de La Habana (Cuba), 26 July '95 - 23 Aug '95
- Felix Requejo, Universidad Nacional de La Plata (Argentina), 20 Aug '95 - 16 Sept '95
- Mohammad Shahabuddin Jamia Millia Islamia, New Delhi (India), 24 June '95 - 12 Aug '95

Publications

F.C. Matacotta, G. Ottaviani (eds.). Thin film science and technology. World Scientific Publishing Co., Singapore, 1995.

F.C. Matacotta, P. Nozar, K.A. Thomas, G. Calestani, A. Migliori. Synthesis, single crystal growth and structural characterization of the new layered perovskite $Ba_2Cu_{.5}Na_5CO_5$. Mat. Res. Bull., 30, (1995), pp. 821-828.

V.I. Dediu, Q.D. Jiang, F.C. Matacotta, P. Scardi, M. Lazzarino, G. Nieva, L. Civale. Deposition of $MBa_2Cu_3O_{7-x}$ thin films by channel-spark method. Supercond. Sci. Technol., 8, (1995), pp. 160-164.

G. Calestani, P. Ganguly, F.C. Matacotta, P. Nozar, A. Migliori, K.A. Thomas, A. Tomasi. Synthesis, single crystal growth and structural determination of new copper oxycarbonates $A_4CuM(CO_3)_2O_4$, A=Sr, Ba, M=Li, Na, Ca. Physica C, 247, (1995), pp. 359-370.

G. Calestani, F.C. Matacotta, A. Migliori, P. Nozar, L. Righi, K.A. Thomas. Synthesis, crystal growth and structural characterization of $BaM_xCu_{1-x-y}(CO_3)_yO_2$(M=Ca, Cu, Cd, $0<x<0.25$). Physica C, in press.

A. Tomasi, P. Scardi, F.C. Matacotta, P. Nozar. The formation of $Ba(CuO_x)_y(CO_3)_{1-y}$, a new phase in the Ba-Cu-C-O system: thermal analysis results. Journal of Thermal Analysis, in press.

P. Scardi, V. Dediu, F.C. Matacotta, L. Correra. XRD line profile analysis of superconducting thin films. Journal of Material Research, in press.

A. Tomasi, G, Galvanetto, F.C. Matacotta, P. Nozar, P. Scardi, A. Migliori. Kinetic study on the formation of the aragonite-like phase $Ba(CuO_x)_y(CO_3)_{1-y}$. MRS Bull., in press.

F.C. Matacotta, P. Nozar, A. Migliori, G. Calestani, K.A. Thomas, P. Scardi, P. Ruani, P.G. Radaelli. From carbocuprates to cuprocarbonates: the structural equivalence of CO_3 and CuO_x groups in the Ba-Cu-C-O system. Submitted to Angewandte Chemie.

V. Dediu, A. Kursumovic, O. Greco, F. Biscarini, F.C. Matacotta. Observation of the Stranski-Krastanov growth transition in $GdBa_2Cu_3O_7$ films. Submitted to Phys. Rev. Lett.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Asia	2	
Europe	4	1
North and Central America	2	
South America	1	
Total	*9*	*1*
Grand Total	***10***	
Countries represented	7	
Person-months	43.15	

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Title: TEMPUS MEETING ON FIBRE OPTICS

Dates: 6 - 10 February.

Co-sponsor: European Union through Tempus Project.

Directors: Professors J. Budin (University of Ljubljana, Slovenia) and G. Denardo (ICTP).

Purpose: To update the knowledge of the participants and to understand the newest technologies in optical communications.

Programme:

C. DE ANGELIS (University of Padua, Italy) – Non-linear guided-wave optics: motivations and general features (2 lectures).

M. BERTA (Slovak Academy of Sciences, Bratislava, Slovakia) – Technology and fabrication of optical fibres (2 lectures).

F. CAVIGLIA (Centro studi e laboratori telecomunicazioni, CSELT, Turin, Italy) – Cables, devices, installation (2 lectures).

M. SCHIANO (SAIFO, Padua, Italy) – Monitoring and surveillance of optical networks.

R. BOMBARELLI (NECSY S.p.A., Padua, Italy) – Measurements on cables and networks.

D. UTTAMCHANDANI (University of Strathclyde, Glasgow, UK) – Optical amplifiers (2 lectures).

Laboratory exercises on: measurements of refractive index profile of multimode fibres; investigation of farfield pattern and bend losses by means of CCD camera.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Europe	27	5
Total	*27*	*5*
Grand Total	***32***	
Directors and Lecturers	6	
Participants	26	
Countries represented	3	
Person-months	11.96	
Applications received	32	

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Title: CONFERENCE ON ULTRAFAST TRANSMISSION SYSTEMS IN OPTICAL FIBRES

Dates: 13 - 17 February.

Directors: Professors H.A. Haus (Massachusetts Institute of Technology, Cambridge, MA, USA) and G. Denardo (ICTP).

Purpose: To present recent research achievements in the field of high capacity optical communications.

Topics: High bit rate optical systems.
Short pulse generation.
Optical solitons in fibres.

Quantum effects in optical fibre systems.
Er^{+}-doped optical amplifiers.
Transoceanic optical communications.

Programme:

SOLITON THEORY

J.P. GORDON (AT&T Bell Laboratories, Holmdel, USA) – Soliton in Randomly Birefrangent Fibers.
Yuji KODAMA (Ohio State University, Columbus, USA) – Analyses for Soliton Control in Optical Fibres.
H.A. HAUS, F. KHATRI and W. WONG (M.I.T.) – Soliton Far-Field Interactions.
P. MÖBIUS (PFI, Dresden, Germany) – Video and Demonstration of Solitary Excitation.
Open Discussion: Soliton Theory, Where To Next?

SOLITON COMMUNICATIONS

A. HASEGAWA (Osaka University, Japan) – Optical Soliton Communication Systems.

SLIDING GUIDING FILTERS

P. MAMYSHEV and L. MOLLENAUER (AT&T Bell Laboratories, Holmdel, USA) – Long Distance Soliton Transmission Using Sliding Frequency Guiding Filters.
S. WABNITZ (Fondazione Ugo Bordoni, Rome, Italy) – The Sliding Frequency Soliton Laser.
S.G. EVANGELIDES (AT&T Bell Lab., Holmdel, USA) and J.P. GORDON – Some New Theoretical Results on Many Channel Soliton WDM Systems.
Open Discussion: Have We Accounted for All Soliton Interactions?
F. PEMPINELLI (Università di Lecce, Italy) – Video Session: Multidimensional Solitons.
Seminar session.

SOLITON AND OTHER PULSE INTERACTION

A.V. SHIPULIN (Russian Academy of Sciences, Moscow, Russia) – Generation of the High-repetition Rate Train of Picosecond Fundamental Solitons Using Propagation of a Beat Signal Through a Non-uniform Fibre.
K. BLOW (British Telecom Research Laboratories, Ipswich, UK) – Pulse Interaction in Soliton Systems.
T. GEORGES (France Telecom, Lannion, France) – Influence of Soliton Interaction on Soliton Transmission System Performance and Design.
F. FONTANA (Pirelli S.p.A., Milan, Italy) – Solitons in Telecommunications Links: Engineering Issues and Source Optimization.
R. FORK (University of Alabama, Huntsville, USA) – Computational Modelling of Ultrashort Light Pulses.
Visit to the ICTP Laboratory of Lasers and Optical Fibres.

AMPLIFIERS AND MODULATORS

J. MØRK (Tele Danmark Research, Horsholm, Denmark) – Ultrafast Dynamics of Active Semiconductor Waveguides.
H. MELCHIOR (ETH, Zurich, Switzerland) – Optoelectronic Switches, Modulators and Gate Amplifiers for High Speed Fibre-Transmission Systems.
E. DESURVIRE (Alcatel-Alsthom Recherche, Marcoussis, France) – Erbium-doped Fiber Amplifiers: Key Features and Applications.
A. MECOZZI (Fondazione Ugo Bordoni, Rome, Italy) – Amplifier Noise and Kerr Nonlinearity in Long-Haul Transmission Systems Operating Close to Zero Dispersion.
Open Discussion: EDFA vs. Semiconductor Lasers.
Poster Session.

OTHER THAN SOLITON COMMUNICATIONS

S.G. EVANGELIDES Jr. (AT&T Bell Labs., Holmdel, USA) – Long Distance All Optical ASK Transmission Near λ_0: Why Does It Work So Well When We Understand So Little?

N. BERGANO (AT&T Bell Labs., Holmdel, USA) – Long-Haul Optical-Amplifier Transmission Systems Using the Non-Return-to-Zero Modulation Format.

R.I. LAMING (University of Southampton, UK) – Upgrading the Installed Fibre Base.

S. AKIBA (KDD Labs., Kamifukuoka-Shi, Japan) – Long-Haul Lightwave Transmission Systems Using Optical Amplifier Technique.

Panel Discussion.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	8	
Asia	13	2
Europe	19	24
Indonesia and Oceania	1	
North and Central America	3	10
South America	3	
International Organizations		1
Total	*47*	*37*
Grand Total	***84***	
Directors and Lecturers	20	
Participants	64	
Countries represented	38	
Int'l Organizations represented	1	
Person-months	19.17	
Applications received	128	

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Title: SECOND WINTER COLLEGE ON OPTICS

Dates: 20 February - 10 March.

Co-sponsors: International Commission for Optics (ICO).

Directors: Professors A. Consortini (University of Florence, Italy), C. Dainty (Imperial College, London, UK), G. Denardo (ICTP), K. Singh (Indian Institute of Technology, New Delhi, India), and C. Velzel (Philips Research Laboratories, Eindhoven, The Netherlands).

Purpose: To discuss the fundamentals and applications of optics.

Programme:

A. CONSORTINI (University of Florence, Italy) – Diffraction and Imaging (3 lectures).

J.C. DAINTY (Imperial College, London, UK) – Fourier Optics and Information Processing (3 lectures).

F. GORI (University of Rome I, Italy) – Coherence (3 lectures).

P. HARIHARAN (CSIRO, Lindfield, Australia) – Holography (3 lectures).

G. ZACCANTI (University of Florence, Italy) – Light Scattering by Tissues (3 lectures).
A. LEWIS (Hebrew Univ. of Jerusalem, Israel) – Near-field Optics (3 lectures).
K. SINGH (Indian Institute of Technology, New Delhi, India) – Photorefractive Effect and Applications (3 lectures).
Y. TSUNODA (Hitachi Ltd., Tokyo, Japan) – Optical Storage (3 lectures).
S. SVANBERG (Lund Inst. of Technology, Sweden) – Optics for Environmental Sensing (2 lectures).
G. LONGOBARDI (Ist. Nazionale di Ottica, Arcetri, Italy) – Detectors (3 lectures).
C.H.F. VELZEL (Philips Research Laboratories, Eindhoven, The Netherlands) – Super-resolution (2 lectures).
J. TURUNEN (Univ. of Joensuu, Finland) – Diffractive Optics (3 lectures).
F. MERKLE (Carl Zeiss Jena GmbH, Germany) – Adaptive Optics (3 lectures).
M. INGUSCIO (Laboratorio europeo di spettroscopie nonlineari, Florence, Italy) – Laser Molecular Spectroscopy (3 lectures).
P. CHAVEL (Inst. d'Optique Théorique et Appliquée, Orsay, France) – Optical Computing (3 lectures).

Seminars:
J.C. DAINTY – Adaptive Optics.
A. CONSORTINI – Evanescent Waves.
P. HARIHARAN – Interference at the Single Photon Level.
K. CHALASINSKA-MACUKOW (Univ. of Warsaw, Poland) – Correlation Methods in Optical Information Processing: Theory and Applications.
M. YZUEL (Universidad Autónoma de Barcelona, Spain) – Colour Image Recognition.
S. MALLICK (Inst. d'Optique Théorique et Appliquée, Orsay, France) – Image Correlation Using Photorefractive Materials.

Laboratory sessions.
LAMP Seminars by Participants.
Visit to Synchrotron Radiation Laboratory "Elettra" (Trieste).
General Discussion and Conclusions.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	12	
Asia	25	2
Europe	25	29
Indonesia and Oceania	1	1
North and Central America	3	
South America	9	
International Organizations		1
Total	*75*	*33*
Grand Total	***108***	
Directors and Lecturers	19	
Participants	89	
Countries represented	47	
Int'l Organizations represented	1	
Person-months	65.99	
Applications received	249	

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Title: AFRICAN REGIONAL COLLEGE ON MICROPROCESSOR-BASED REAL-TIME CONTROL OF EQUIPMENT: PRINCIPLES AND APPLICATIONS IN PHYSICS, held in Cape Coast, Ghana

Dates: 25 September - 13 October.

Co-sponsors: Ghana National Petroleum Corporation (Tema, Ghana), and the United Nations University (Tokyo, Japan).

Directors: Professors N.N. Quaynor (University of Accra, and Network Computer Systems, Accra, Ghana), and C. Verkerk (ICTP), in collaboration with the University of Cape Coast and Network Computer Systems with the support of the Ghana Atomic Energy Commission.

Purpose: To teach how to make use of the facilities a real-time operating system (or a real-time kernel) offers when designing and implementing computer control of experiments.

Programme:

C. VERKERK (ICTP) – Practical Linux (5 lectures).

C.M. TANG (AT&T Microelectronics, Singapore) – Programming in C (6 lectures).

C. VERKERK (ICTP) – Toward Real-Time Linux (5 lectures).

J. WETHERILT (Scient. and Technical Res. Council of Turkey, Gebze Kocaeli, Turkey) – Hardware Interfacing and Introduction to the Colombo Board.

C.M. TANG (AT&T Microelectronics, Singapore) – VLSI: Now and the foreseeable future (3 lectures).

U. RAICH (CERN) – Writing a Linux device driver (3 lectures).

C.S. ANG (3 Ss24/7, Petaling Jaya, Malaysia) – Cross-development of embedded systems (5 lectures).

U. RAICH (CERN) – Writing X11 applications (6 lectures).

P. BARTHOLDI (Observatoire de Genève, Switzerland) – Software Design Methodology (8 lectures).

A. NOBILE (ICTP) – Practical Networking (5 lectures).

Laboratory exercises.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	42	
Asia	2	
Europe		3
International Organizations		2
Total	*44*	*5*
Grand Total	***49***	
Directors and Lecturers	8	
Participants	41	
Countries represented	14	
Int'l Organizations represented	2	
Person-months	28.87	
Applications received	45	

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Title: IX INTERNATIONAL SYMPOSIUM ON ULTRAFAST PROCESSES IN SPECTROSCOPY (UPS '95)

Dates: 30 October - 3 November.

Co-sponsors: Istituto nazionale di fisica della materia (INFM, Italy), Italian National Research Council (CNR), Politecnico di Milano, European Physical Society (EPS).

Directors: Professors S. De Silvestri (Politecnico di Milano, Italy), G. Denardo (ICTP), and O. Svelto (Politecnico di Milano, Italy).

Purpose: To follow-up to the UPS Meetings which had been held in Bayreuth (Germany) and Vilnius (Lithuania) and to discuss recent experimental and theoretical results on ultrafast processes.

Programme:

Femtosecond fiber lasers. E.P. Ippen, K. Tamura, C.R. Doerr, L.E. Nelson, and H.A. Haus *Massachusetts Institute of Technology, Cambridge, USA.*

Frontiers in high-intensity physics. G. Mourou *University of Michigan, Ann Arbor, USA.*

Femtosecond time-resolution in scanning tunneling microscopy. W. Pfeiffer and G. Gerber, *Universität Würzburg, Germany;* R. Moller, *Universität Stuttgart, Germany.*

ULTRASHORT PULSE LASERS I

All solid-state tunable ultrafast laser oscillators and amplifiers for real-world applications including medical imaging. N.P. Barry, J.C. Dainty, P.M.W. French, S.C.W. Hyde, R. Jones, R. Mellish, and J. Taylor, *Imperial College, London, UK.*

Powerful ultrashort pulse generation in Ti:Sapphire. M. Lenzner, Ch. Spielmann, and F. Krausz, *Technische Universität Wien, Austria;* R. Szipocs, *Research Institute for Solid State Physics, Budapest, Hungary.*

Theory of soliton mode-locked femtosecond solid state lasers. F.X. Kartner, *Swiss Federal Institute of Technology, Zurich, Switzerland.*

Self-starting, self-mode-locked all solid state Cr:LISAF laser. F. Falcoz, F. Balembois, P. Georges, G. Roger, and A. Brun, *Institut d'Optique Théorique et Appliquée, Orsay, France.*

ULTRAFAST SPECTROSCOPY OF ATOMS AND MOLECULES I

Three-and-five wave mixing spectroscopy with femtosecond pulses to study conformational changes in chiral molecules in liquid solutions. N.I. Koroteev, A.V. Balakin, A.Yu. Pakulev, A.Yu. Resniansky, A.P. Shkurinov, *Lomonosov Moscow State University, Russia.*

Picosecond study of energy and electron transfer processes in self-organized porphyrin and chlorin multimolecular complexes. C. von Borczyskowski and U. Rempel, *University of Technology Chemnitz-Zwickau, Chemnitz, Germany;* E. Zenkevich, A.M. Schulga, and A. Chernook, *Institute of Molecular and Atomic Physics, Minsk, Belarus.*

Vibrational coherence in photoisomerization reaction of cis-stilbene in solution. D.K. Palit, *Bhabha Atomic Research Centre, Bombay, India;* A.Z. Szarka, N. Pugliano, and R.M. Hochstrasser, *University of Pennsylvania, Philadelphia, USA.*

Solute-Solvent interactions studied by phaselocked heterodyne detected stimulated photon echo and phase locked pump-probe. W.P. de Boeij, M.S. Pshenichnikov, and D.A. Wiersma, *University of Groningen, The Netherlands.*

Unusual ultrafast stilbene-like photophysics of novel ethene-bridged porphyrin dimers. V.S. Chirvony and A.M. Shulga, *Institute of Molecular and Atomic Physics, Minsk, Belarus;* M. Chachisvilis and V. Sundstrom, *University of Umeå, Sweden.*

Probing intermolecular dynamics in liquids by time-resolved optical heterodyne detected Ramaninduced Kerr effect spectroscopy (OHD-RIKES). P. Cong, H.P. Deuel, and J.D. Simon, *University of California, San Diego, USA.*

ULTRASHORT PULSE LASERS II

Mode-locking of solid state lasers by cascaded second order nonlinearities. V. Magni, G. Cerullo, A. Monguzzi, S. De Silvestri, and O. Svelto, *Centro di Elettronica Quantistica, Politecnico di Milano, Italy.*

Advances in ultrafast all-solid-state lasers using semiconductors saturable absorbers. U. Keller, *Swiss Federal Institute of Technology, Zurich, Switzerland.*

Recent progress in femtosecond fiber lasers. E. Yoshida and M. Nakazawa, *NTT Corporation, Tokai, Japan.*

Low-threshold femtosecond solid-state lasers. W. Sibbett, *University of St. Andrews, UK.*

ULTRAFAST SPECTROSCOPY OF ATOMS AND MOLECULES II

Ultrafast photon echo and pump-probe spectroscopy of molecular excitons. M. van Burgel, D.A. Wiersma, and K. Duppen, *University of Groningen, The Netherlands.*

Photodissociation Dynamics of I_3: comparison of ultrafast pump probe experiments to Raman scattering. G. Ashkenazi, R. Kosloff, and S. Ruhman, *The Hebrew University, Jerusalem, Israel.*

Intraligand charge-transfer as a trigger for cation photorelease. M.M. Martin, P. Plaza, and Y.H. Meyer, *Université Paris-Sud, Orsay, France.*

Coherent phonons in fullerites under femtosecond laser excitation. A.L. Dobryakov, V.M. Farztdinov, V.S. Letokhov, Yu.E. Lozovik, and Yu.A. Matveets, *Institute of Spectroscopy, Academy of Science, Troitsk, Russia;* N.P. Ernsting and S.A. Kovalenko, *Max-Planck-Institut, Göttingen, Germany;* G. Marowsky, *Laser-Laboratorium, Göttingen, Germany.*

Spontaneous anti-Stokes Raman spectroscopy with picosecond pulses. M. Hofmann and H. Graener, *Universität Bayreuth, Germany.*

Femtosecond intramolecular charge separation in DCM. H. Zhang, A.M. Jonkman, P. van der Meulen, and M. Glasbeek, *University of Amsterdam, The Netherlands.*

ULTRAFAST NON LINEAR OPTICAL PHENOMENA

Ultrafast temporal dynamics in an optical microscopic cavity. A. Aiello, F. De Martini, M. Giangrasso, and P. Mataloni, *University of Rome, Italy.*

Spatially and temporally nondiffracting ultrashort pulses. P. Saari, *Institute of Physics, Tartu, Estonia.*

Spectroscopy of ultrafast processes in laser crystals and semiconductor nanometer size structures as basis for creation of Kerr-lens and Kerrshift frequency mode-locked solid-state lasers. V.P. Mikhailov, *Belarus State University, Minsk, Belarus.*

High frequency bright and dark soliton sources based on dispersion profiled fibre circuitry and their applications. D.J. Richardson, R.P. Chamberlin, L. Dong, and D.N. Payne, *Optoelectronics Research Centre, University of Southampton, UK;* A.D. Ellis, T. Widdowson, W.A. Pender, and D.M. Spirit, *British Telecom Laboratories, UK.*

ULTRAFAST SPECTROSCOPY IN SEMICONDUCTORS I

Optical cross-talk between quantum wells. J. Feldmann, D. Weber, R. Hellmann, M. Koch, and E.O. Gobel, *Philipps-Universität of Marburg, Germany.*

Ultrafast hole relaxation dynamics in bulk GaAs. R. Tommasi, P. Langot, and F. Vallee, *Laboratoire d'Optique Quantique, CNRS, Ecole Poytechnique, Palaiseau, France.*

Ultrafast coherent exciton spectroscopy and carrier control in quantum structures. J.J. Baumberg and A.P. Heberle, *Hitachi Cambridge Lab., University of Cambridge, UK;* K. Kohler, *Fraunhofer-Institut, Freiburg, Germany;* K. Ploog, *Paul-Drude-Institut, Berlin, Germany.*

Ultrafast dynamics of excitonic resonances in InGaAs/InP MQWs. M. Nisoli, S. De Silvestri, and O. Svelto, *Centro di Elettronica Quantistica, Politecnico di Milano, Italy;* D. Campi and C. Coriasso, *CSELT, Torino, Italy;* A. Varanavicius, *University of Vilnius, Lithuania.*

Shorter than 100 fs carrier lifetimes in As-grown by low temperature MBE GaAs. S. Marcinkevicius and U. Olin, *Royal Institute of Technology, Stockholm, Sweden;* A. Krotkus and R. Viselga, *Semiconductor Physics Institute, Vilnius, Lithuania.*

The importance of biexcitons in four-wave mixing experiments in quantum wells with interface disorder. G. Bongiovanni, D. Leadly, and A. Mura, *Università di Cagliari, Italy;* J.L. Staehli, *Ecole Polytechnique Federale, Lausanne, Switzerland.*

INTENSE ULTRASHORT PULSES

Toward 100 TW, 300 fs glass laser. C. Rouyer, C. Sauteret, and A. Migus, *Centre d'Etudes de Limeil-Valenton, St. Georges, France.*

High-brightness excimer lasers. S. Szatmari, *JATE University, Szeged, Hungary;* G. Almasi, *JPTE University Pecs, Hungary;* M. Feuerhake and P. Simon, *Laser Laboratorium Göttingen, Germay.*

Efficient frequency doubling of the femtosecond terawatt power Ti:sapphire laser pulses. V. Sirutkaitis, E. Gaizauskas, and A. Piskarskas, *Vilnius University, Lithuania;* A. Persson and S. Svanberg, *Lund Institute of Technology, Lund, Sweden.*

Progress in the development of ultrabright lasers at 249 nm. 1. N. Ross, M.J. Shaw, E.J. Divall, G.J. Hirst, C.J. Hooker, A. Kvaran, J.M.K. Lister, *Rutherford Appleton Laboratory, Chilton, UK;* K. Osvay, *JATE University, Szeged, Hungary.*

How far are we from the table-top multihertz petawatt fs-laser? G. Korn, *Max Born Institut, Berlin, Germany;* C.P.J. Barty, F. Raksi, C. Rose-Petruck, J. Squier, K.R. Wilson, V.V. Yakovlev, K. Yamakawa, *University of California, San Diego, USA.*

ULTRAFAST SPECTROSCOPY IN SEMICONDUCTORS II

Time-resolved spectroscopy in semiconductors using intense far-infrared (sub)picosecond pulses. P.C.M. Planken, H.P.M. Pellemans, P.C. van Son, J.N. Hovenier, T.O. Klaassen, and W.Th. Wenckebach, *Delft University of Technology, The Netherlands,* C.J.G.M. Langerak, *FOM Institute for Plasma Physics, Nieuwegein, The Netherlands.*

Influence of many-body effects on quantum coherence of 2D excitons in GaAs quantum wells. J. Kuhl, E.J. Mayer, M. Hubner, and G.O. Smith, *Max-Planck-Institut, Stuttgart, Germany;* K. Bott, V. Heuckeroth, D. Ennhardt, S.W. Koch, and P. Thomas, *Philipps University, Marburg, Germany.*

Exciton/exciton coupling in multiple quantum well Bragg structure. M. Hubner, E.J. Mayer, N. Pelekanos, and J. Kuhl, *Max-Planck-Institut, Stuttgart, Germany,* R. Hey and K. Ploog, *Paul Drude Institut, Berlin, Germany.*

Carrier transport in multiple quantum well regions in InGaAsP/InP structures. S. Marcinkevicius, *Royal Institute of Technology, Stockholm. Sweden;* U. Olin, *Institut of Optical Research, Stockholm. Sweden;* C. Silfvenius, B. Stalnacke, and G. Landgren, *Royal Institute of Technology, Kista, Sweden.*

Spin relaxation of excitons localized in GaAs/AlGaAs coupled quantum wells structures. A.L.C. Triques, *Universidade Estadual de Campinas, Brazil;* A. Vinattieri, M. Colocci, *Università di Firenze, Italy;* P. Roussignol, *Ecole Normale Supérieure, Paris, France.*

Quantum beats in photoluminescence of excitons in ZnSe/ZnSeTe superlattice quantum wells. X.G. Zheng, H.Z. Wang, Z.X. Yu, F.L. Zhao, Z.L. Zhang, C. Xie, W.Z. Lin, and G. Zu, *Zhangshan University, Guangzhou, China.*

APPLICATIONS OF INTENSE ULTRASHORT PULSES I

Generation of x-ray by ultrashort pulse laser produced plasma. P. Audebert, J.P. Geindre, S. Bastiani, and J.C. Gauthier, *Ecole Polytechnique, Palaiseau, France;* G. Grillon, R. Evans, and A. Mysyrowicz, *Laboratoire d'Optique Appliquée, ENSTA, Palaiseau, France.*

Time and spatial soliton with femtosecond uv laser pulse. Xin Miao Zhao, *Los Alamos National Laboratory, USA;* P. Rambo and J.C. Diels, *University of New Mexico, Albuquerque, USA.*

High harmonic generation effciency. K. Burnett, X. Chen, A. Sanpera, and J.B. Watson, *University of Oxford, UK.*

Picosecond interferometry of plasmas before and after short laser pulse propagation. A. Giulietti, L.A. Gizzi, and A. Macchi, *Istituto di Fisica Atomica e Molecolare CNR, Pisa, Italy,* M. Borghesi, *Imperial College of Science, London, UK;* C. Danson and D. Neely,

Rutherford Appleton Laboratory, Chilton, UK, D. Giulietti, *Università di Pisa, Italy.*

ULTRAFAST SPECTROSCOPY IN SEMICONDUCTORS III

Ultrafast carrier transfer in quantumwell and hetero-nipi-structures. A Seilmeier, *University of Bayreuth, Germany.*

Quantum description and simulation of the femtosecond response of highly photoexcited charge carriers in semiconductors. P Kocevar, *Karl-Franzens University, Graz, Austria*

Femtosecond spectroscopy of hot carriers in low dimensional semiconductors. M. Woerner, S Lutgen, and T. Elsaesser, *Max-Born Institut, Berlin, Germany.*

Ultrafast recovery of transient changes in the exciton optical properties of InGaAs/InP quantum wells. D Campi and C Coriasso, *CSELT, Torino, Italy;* M. Nisoli and S De Silvestri, *Politecnico di Milano, Italy.*

Recombination dynamics of near-bandedge emission in cubic GaN. R. Klann, H.T. Grahn, O Brandt, H. Yang, and K. Ploog, *Paul-Drude-Institut, Berlin, Germany.*

APPLICATIONS OF INTENSE ULTRASHORT PULSES II

Resonant and near resonant femtosecond fourwave mixing experiments under the condition of coherent two photon interaction. O. Kittelmann, J. Ringling, and G. Korn, *Max Born Institut, Berlin, Germany,* A. Nazarkin, *Lebedev Physics Institute, Moscow, Russia*

Investigation of dense, femtosecond laser generated electron-hole plasmas in silicon. K. Sokolowski-Tinten, J. Bialkowsky, and D. von der Linde, *Universität-GHS-Essen, Essen, Germany*

High harmonic generation as a recollision process. P.L. Knight and C.H. Keitel, *Imperial College, London, UK;* K Burnett and J.B. Watson, *University of Oxford, UK*

Electron imaging in short-pulse strong-field multiphoton ionization. V. Schyja, T Lang, M J Dyer, and H Helm, *Albert-Ludwigs-Universitat, Freiburg, Germany.*

ULTRAFAST SPECTROSCOPY OF METALS AND INSULATORS

Transient polarization sensitive reflective spectroscopy of semiconductors and metals. N.I. Zheludev, *University of Southampton, UK.*

Temperature dependence of second order susceptibility of noble metals near the interband transition threshold. J. Hohlfeld, U. Conrad, and E. Matthias, *Freie Universität Berlin, Germany,* D. Grosenick, *Max-Born-Institut, Berlin, Germany.*

Electronic excitation enhanced crystallization of amorphous films? J. Solis and C.N Afonso, *Instituto de Optica, CSIC, Madrid, Spain,* S C.W. Hyde, N.P. Barry, and P.M.W. French, *Imperial College of Science and Technology, London, UK.*

Time resolved studies of free carriers in insulators. Ph. Daguzan, S. Guizard, P. Martin, and G Petite, *CEA, CFN Saclay, France.*

Ultrafast infrared free electron nonlinearity in bulk metals. P.J. Bennett, S.V. Popov, I.R. Shatwell, Yu.P Svirko, and N.I. Zheludev, *University of Southampton, UK;* V E. Gusev, *University of Heidelberg, Germany.*

APPLICATIONS OF INTENSE ULTRASHORT PULSES III

Generation of short pulse tunable vuv and xuv radiation. B. Wellegehausen, K. Mossavi, H Eichmann, *Universitat Hannover, Germany.*

Generation of high order harmonics from solid surfaces with intense femtosecond laser pulses. D. von der Linde, G. Jenke, T. Engers, *Universität Essen, Germany;* P. Agostini, *Commissariat à l'Energie Atomique, Saclay, France.*

Optical-harmonic generation and frequency mixing in the field of picosecond laser pulses in the plasma of optical breakdown. A B Fedotov and A M Zheltikov, *Moscow State University, Russia.*

Reflection and transmission of high intensity femtosecond pulse focused on very thin plastic foils. D. Giulietti, *Universita di Pisa, Italy,* L A Gizzi, V Biancalana, T Ceccotti, *Istituto di Fisica Atomica e Molecolare-CNR, Pisa, Italy,* P. Audebert, J.P. Geindre, and A Mysyrowicz, *Ecole Polytechnique, Palaiseau, France*

Nonlinear optical phenomena in femtosecond near-surface high temperature plasma induced by interfering beams. A.P. Tarasevitch, V.M. Gordienko, M.S. Djidjoev, S.A. Magnitskii, V.T. Platonenko, A.B. Savel'ev, and R.V. Volkov, *Moscow State University, Russia.*

ULTRAFAST SPECTROSCOPY OF ATOMS AND MOLECULES III

A 13-fs cavity dumped Ti:Sapphire laser: novel applications for ultrafast spectroscopy. M.S. Pshenichnikov, W.P. de Boeij, and D.A. Wiersma, *University of Groningen, The Netherlands.*

Vibrational and vibronic dynamics of large molecules in solution studied on a 20 fs time scale. E. Riedle, T. Hasche, S.H. Ashworth, M. Woerner, and T. Elsaesser, *Max Born Institut, Berlin, Germany.*

Vibrational population dynamics in liquids and glasses: IR pump-probe experiments from 10 K to 300 K. C. Ferrante, A. Tokmakoff, C. Taiti, A.S. Kwok, R.S. Francis, K.D. Rector, and M.D. Fayer, *Stanford Unlversity, CA, USA.*

Short pulse experiments on the electron dynamics of Rydberg atoms in external fields. J. Wals, H.H. Fielding, and H.B. van Linden van den Heuvell, *University of Amsterdam, The Netherlands.*

Transient and steady state optically induced anisotropy in J-aggregates of pseudoisocyanine chloride. A. Baltuska, R. Gadonas, and A. Pugzlys, *Vilnius University, Lithuania,* G. Onusauskas and C. Rulliere, *Université de Bordeaux 1, Talence, France.*

PARAMETRIC AMPLIFICATION AND FREQUENCY CONVERSION

Traveling wave optical parametric generation: latest developments. R. Danielius, and A. Piskarskas, *University of Vilnius, Lithuania.*

Compensation of group velocity mismatch in a blue-pumped non-collinear parametric generator of femtosecond pulses. P. Di Trapani and A. Andreoni, *Università di Como, Italy;* C. Solcia and G.P. Banfi, *Università di Pavia, Italy,* P. Foggi, *LENS, Firenze, Italy;* R. Danielius and A. Piskarskas, *University of Vilnius, Lithuania.*

Fivefold femtosecond pulse compression by sumfrequency generation. A. Aranavicius, G. Valiulis, *University of Vilnius, Lithuania,* M. Nisoli and S. De Silvestri, *Centro Elettronica Quantistica-CNR, Politecnico di Milano, Italy.*

Application of parametric amplification for tunable visible ultrashort laser sources and for optical imaging of diffuse media. J. Watson, P. Georges, T. Lepine, and A. Brun, *Institut d 'Optique Théorique et Appliquée - CNRS, Orsay, France.*

Femtosecond high contrast tunable pulses from BBO TOPG pumped by self-compressed second harmonic of Nd:Glass laser. R. Danielius, A. Dubietis, G. Valiulis, and A. Piskarskas, *Vilnius University, Lithuania.*

Green-light generation of picosecond pulses in first-order quasi-phase-matched lithium niobate. V. Pruneri, S.D. Butterworth, P.St.J. Russell, and D.C. Hanna, *University of Southampton, UK;* J. Webjorn, *Spectra Diode Labs, San Jose, California, USA.*

ULTRAFAST SPECTROSCOPY OF ATOMS AND MOLECULES IV

Ultrafast intramolecular proton transfer in the condensed phase studied by resonance Raman and femtosecond spectroscopy. T. Elsaesser, M. Pfeiffer, K. Lenz, A. Lau, C. Chudoba, S. Lutgen, T. Jentzsch, and M. Woerner, *Max-Born Institute, Berlin, Germany.*

Temperature-dependent vibrational dynamics and inhomogeneous broadening in glass-forming liquids studied with infrared photon echoes. A. Tokmakoff, *Technische Universität München, Garching, Germany;* M.D. Fayer, *Stanford University, CA, USA.*

Femtosecond pump-probe spectroscopy on the K2 molecule-perturbations and high laser fields. S. Rutz, E. Schreiber, and L. Woste, *Freie Universität Berlin, Germany.*

Ultrafast dynamics in aqueous ionic solutions by femtosecond optical Kerr effect. M. Bellini, P. Foggi, D. Kien, and R. Righini, *LENS, Università di Firenze, Italy;* I. Santa, *Janus Pannonius University, Pecs, Hungary.*

Femtosecond dynamics of the ground state of Ag_3: time-resolved spectroscopy of mass-selected neutral clusters. E. Schreiber, T. Leisner, S. Rutz, S. Wolf, and L. Woste, *Freie Universität Berlin, Germany.*

Femtosecond dynamics of I_2 molecule in rare gas solids. R Zadoyan, M Sterling, and V A Apkarian, *University of California, Irvine, CA, USA*

FEMTOSECOND OPTICAL PARAMETRIC OSCILLATORS

Generation of highly coherent tunable femtosecond pulses at 82 MHz in the visible and midinfrared using a blue pumped optical parametric oscillator. G M Gale, *Ecole Polytechnique, Palaiseau, France*

Mirror-dispersion-compensated optical parametric oscillator. J Hebling, *JATE University, Szeged, Hungary,* E J Mayer and J Kuhl, *Max-Planck-Institut, Stuttgart, Germany,* R Szipocs, *Research Institute for Solid State Physics, Budapest, Hungary*

Kerr-lens mode-locking of a subpicosecond optical parametric oscillator. R Laenen, C Rauscher, and A Laubereau, *Technische Universitat Munchen, Germany*

CW mode-locked optical parametric oscillators in the wavelength range from 520 nm to 10 μm. R Beigang, C Fallnich, Ch Graber, B Kohler, A Nebel, B Ruffing, D Wang, and R Wallenstein, *Universitat Kaiserslautern, Germany*

ULTRAFAST NONLINEAR OPTICS IN ORGANICS I

Femtosecond dynamics in conjugated polymers. T Kobayashi, *University of Tokio, Japan*

Ultrafast dynamics of delocalized states in a polydiacetylene backbone. J Y Bigot, and T A Pham, *Institut de Physique et Chemie des Materiaux de Strasbourg, France*

Femtosecond relaxation dynamics in thiophene oligomers. G Lanzani, *Universita di Sassari, Italy,* M Nisoli and S De Silvestri, *Politecnico di Milano, Italy,* R Tubino, *Universita di Milano, Italy*

Sub-picosecond optical non-linearities in excited states of diphenyl-polyenes and "push-pull" polyenes enhancement and fast dynamics. G Jonusauskas, J Oberle, and C Rulliere, *Universite Bordeaux I, Talence, France*

APPLICATIONS OF ULTRAFAST LASERS IN MEDICINE

Imaging through diffusing media with time resolved transmittance. R Cubeddu, A Pifferi, P Taroni, A Torricelli, and G Valentini, *Centro di Elettronica Quantistica, Politecnico di Milano, Italy*

Time and space resolved reflectance for the measurement of optical coefficients of tissue. J M Tualle, B Gelebart, and S Avrillier, *Laboratoire de Physique des Lasers, Universite Paris XIII, Villetaneuse, France*

Application of ultrashort x-ray pulses to biological and medical imaging. S Svanberg, M Gratz, J Mercer, and C Tillman, *Lund Institute of Technology, Sweden*

Biomedical imaging and optical biopsy using optical coherence tomography. J G Fujimoto, G Tearney, B Bouma, S Boppart, and M Hee, *Massachusetts Institute of Technology, Cambrige, USA,* E A Swanson, *MIT Lincoln Laboratory, Lexington, USA,* C A Puliafito and J Schuman, *New England Eye Center Tufts University School of Medicine, Boston, USA,* M Brezinski, *Massachusetts General Hospital, Boston, USA*

ULTRAFAST NON LINEAR OPTICS IN ORGANICS II

Ultrafast optical probes of excited states in conducting polymers. Z V Vardeny, *University of Utah, Salt Lake City, USA*

Femtosecond pump and probe experiments on films and solutions of conjugated Poly(ParaPhenylene)-Type ladderpolymers. W Graupner and G Leising, *Technische Universitat Graz, Austria,* G Lanzani, *Universita di Sassari, Italy,* M Nisoli and S De Silvestri, *Centro di Elettronica Quantistica e Strumentazione Elettronica-CNR, Milano, Italy,* U Sherf, *Max-Planck-Institut, Mainz, Germany*

High sensitivity ultrafast nonlinear medium for all-optical signal processing based on J-aggregate systems. K-H Feller, *Technical University of Jena, Germany,* R Gadonas, *University of Vilnius Lithuania*

Laser induced processes in oligothiophenes studied by ps- and fs-time resolved spectroscopy. S Rentsch,, D V Lap, D Grebner, and M Helbig, *Friedrich-Schiller-Universitat Jena, Gennany*

Multi-exciton effects in low-dimensional organics with femtosecond pulses.

N. Peyghambarian, *University of Arizona, Tucson, USA.*

ULTRAFAST PROCESSES IN BIOPHYSICS

Femtosecond IR spectroscopy in molecular physics and biophysics. P. Hamm, M. Zurek, and W. Zinth, *Institut of Medizinische Optik, Universität München, Germany.*

Oscillations in the transient absorption signals from isolated bacterial reaction centers and photosynthetic antenna complexes. M.G. Muller and A.R. Holzwarth, *Max-Plank-Institut, Mulhelm a.d. Ruhr, Germany.*

Ultrafast relaxation of light energy in photosynthetic antenna proteins. A. Freiberg, S. Lin, and R.E. Blankenship, *Arizona State University, Tempe, USA.*

Hemoglobin oxygenation dynamics on picosecond time scale. B.M. Dzhagarov, N.N. Kruk, and S.A. Tikhomirov, *Institute of Molecular and Atomic Physics, Minsk, Belarus.*

Femtosecond transient absorption study of ultrafast primary processes in the isolated photosynthetic reaction center of photosystem II. A.R. Holzwarth, M.G. Muller, and M. Hucke, *Max-Planck-Institut, Mulhelm a. d. Ruhr, Germany.*

Primary photoprocesses in biologically active pigments related to photosensitized tumor therapy. R. Rotomskis, *Lithuanian Center of Oncology, Vilnius, Lithuania.*

TERAHERTZ SPECTROSCOPY AND SUPERCONDUCTORS

Coherent processes in high-T_c superconductors: coherent phonons and Josephson plasma oscillations. H.G. Roskos, C. Jaekel, G. Kyas, M. Shroer, and H. Kun, *Rheinisch-Westfalische Technische Hochschule (RWTH), Aachen, Germany.*

Generation propagation and detection of terahertz radiation from biased semiconductors dipole antennas. P.U. Jepsen, R.H. Jacobsen, and S.R. Keiding, *Århus University, Denmark.*

THz bloch oscillations in superlattices. T. Dekorsy, R. Ott, P. Leisching, H.J. Bakker, and H. Kurz, *RWTH, Aachen, Germany;* K. Kohler, *Fraunhofer Institut, Freiburg, Germany.*

Electrodynamics of high-T_c superconductors studied using THz pulse spectroscopy. S.T. Brorson, R. Buhleier, I.E. Trofimov, J.O. White, C. Ludwig, H.-U. Haberrneier, and J. Kuhl, *Max-Planck-Institut, Stuttgart, Germany.*

Nonlinear detection of high-power terahertz radiation. P.U. Jepsen, M. Schall, V. Schyja, C. Winnewisser, and H. Helm, *Albert-Ludwigs Universität, Freiburg, Germany.*

Terahertz beam from dielectrics with femtosecond optics. X.-C. Zhang, *Rensselaer Polytechnic Institute, Troy, NY, USA.*

NEW ULTRAFAST MEASUREMENT TECHNIQUES I

Phase-resolved spectroscopy for linear and nonlinear optics using 10 femtosecond pulses. M. Joffre, L. Lepetit, A. Migus, and D. Hulin, *ENSTA-Ecole Polytechnique, Palaiseau, France.*

Ultrahigh resolution intracavity phase spectroscopy with mode-locked ring laser. J.C. Diels, S. Diddams, and B. Atherton, *University of New Mexico, Albuquerque, USA.*

Femtosecond interferometric correlations between coherent polarization waves: a novel approach to dephasing and quantum beats. S. Ceccherini, F. Bogani, M. Colocci, and M. Gurioli, *LENS and University of Florence, Italy.*

Measurement of the intensity and phase of ultrashort pulses using frequency-resolved optical gating (FROG). R. Trebino, K.W. DeLong, D.N. Fittinghoff, and C.L. Ladera, *Sandia National Laboratory, Livermore, USA;* G. Taft, A. Runquist, M.M. Murnane, and H.C. Kapteyn, *Washington State University, Pullman, USA.*

ULTRAFAST SPECTROSCOPY IN QUANTUM CONFINED SYSTEMS

Femtosecond hole relaxation in CdTe quantum dots. C.H. de Brito Cruz and S. Tsuda, *University of Campinas, Brazil.*

Saturable absorption dynamics of a semiconductor doped glass. M. Wittmann and A. Penzkofer, *Universität Regensburg, Regensburg, Germany.*

Gain dynamics in CdSe quantum dots. U. Woggon, *Universität Karlsruhe, Germany;* H. Giessen, B. Fluegel, G. Mohs, Y.Z. Hu, and N. Peyghambarian, *University of Arizona, Tucson, USA;* S.W. Koch, *Philipps-Universität, Marburg, Germany.*

Femtosecond studies of interfacial electron dynamics in colloidal metal nanoparticles: size confinement effect on electron energy relaxation. J.Z. Zhang, B.A. Smith, and A.E. Faulhaber, *University. of California, Santa Cruz, USA.*

Ultrafast thermalization process in PdTe quantum size films studying by biharmonic pumping technique. A.G. Kornienko, V.M. Petnikova, V.V. Shuvalov, *Moscow State University, Russia,* L.N. Vereshchagina and A.N. Zherikhin, *Scientific Research Center for Technological Lasers, Moscow, Russia.*

Picosecond all-optical switching in thin-film Fabry-Perot interferometers and cavityless devices. O.V. Goncharova and S.A. Tikhomirov, *Inst. of Molecular and Atomic Physics, Academy of Sciences, Minsk, Belarus.*

NEW ULTRAFAST MEASUREMENT TECHNIQUES II

New interferometric methods for group-delay measurement using white-light illumination. A.P. Kovacs, G. Kurdi, K. Osvay, J. Hebling, and Z. Bor, *JATE University, Szeged, Hungary;* R. Szipocs, *Research Institute for Solid State Physics, Budapest, Hungary.*

Measurement and adjust of ultrashort light pulses. G.A. Sanchez and O.E. Martinez, *Universidad de Buenos Aires, Argentina.*

Ultrafast spectroscopy through direct measurement of the phase of the nonlinear polarization. L. Canioni, P. Segonds, B. Bousquet, F. Adamietz, S. Le Boiteux, and L. Sarger, *Université Bordeaux, Talence, France.*

ULTRAFAST OPTOELECTRONICS

Ultrafast sampling of a dual-gate FET for hot electron transport dynamics. N. de B. Baynes, J.R.A. Cleaver, and J. Allam, *Cavendish Laboratory, University of Cambridge, UK.*

Electric field dynamics at a metal-semiconductor interface probed by time resolved femtosecond optical second harmonic generation. W. de Jong, A.F. van Etteger, C.A. van 't Hof, and Th.H.M. Rasing, *Research Institute for Materials, Nijmegen, The Netherlands;* P.J. van Hall, *Eindhoven University, The Netherlands.*

Dynamics of trapping, recombination and breakdown in LT CaAs. J. Allam and N. de B. Baynes, *Cavendish Laboratory, University of Cambridge, UK.*

Ultrafast scanning tunneling microscopy using integrated optoelectronic switches. R.H.M. Groeneveld, Th.H.M. Rasing, and H. van Kempen, *Nijmegen, The Netherlands;* L.M.F. Kaufmann and J.H. Wolter, *Eindhoven University, Eindhoven, The Netherlands;* M.R. Melloch, *Purdue University, West-Lafayette, USA.*

Poster sessions.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia	14	3
Europe	39	130
North and Central America		16
South America	2	
International Organizations		1
Total	*57*	*150*
Grand Total	***207***	
Directors and Lecturers	3	
Participants	204	
Countries represented	29	
Int'l Organizations represented	1	
Person-months	42	
Applications received	302	

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Title: THIRD SCHOOL ON THE USE OF SYNCHROTRON RADIATION IN SCIENCE AND TECHNOLOGY: 'JOHN FUGGLE MEMORIAL'

Dates: 30 October - 1 December.

Co-sponsors: International Centre for Science and High Technology (ICS, Trieste), Sincrotrone Trieste S.p.A., and Società Italiana di Luce di Sincrotrone (SILS, Italy).

Directors: Professors A. Craievich (National Laboratory for Synchrotron Radiation, Campinas, Brazil), C.S. Fadley (Lawrence Berkeley Laboratory, CA, USA), L. Fonda (Sincrotrone Trieste S.p.A., Trieste), A. Fontaine (Laboratoire pour l'Utilisation du Rayonnement Electromagnétique, Orsay, and Laboratoire Louis Néel, Grenoble, France), W. Peatman (Berliner Elektronen Speicherring für Synchrotronsstrahlung, Berlin, Germany), and H.J. Wiedemann (Stanford University, CA, USA).

Report:

The use of Synchrotron Radiation (SR) for research in science and technology has grown enormously in the past two decades, so that more than 5,000 scientists in Europe alone, now make regular use of SR in their work. World-wide capacity for research with SR has grown from almost zero in 1970 to the order of 1.5 million beamline hours in 1990, and will increase by about a factor of 2 within a decade. In the developing countries at least 7 full-scale storage rings for SR are in operation or expected to be commissioned within a few years. In addition, research with SR is truly international, with many scientists making use of facilities in other countries to complement work in their home laboratories.

The aim of the School was to cover all aspects of SR from machine physics, insertion devices and beamline design, to actual use of SR. Emphasis was also placed on practical training in vacuum technology and instrumentation, and the use of common experimental techniques. The course material was treated in lectures, exercises and data treatments on personal computers.

The five-weeks School consisted of a five-day working week with about 3 morning lectures per day, and with afternoons devoted to exercises and data treatment sessions on personal computers. The lectures included: Accelerator Physics and SR Sources, Beamline and Monochromator Design, Application of SR to Physics, Chemistry, Materials Science, Surface Science, Geophysics, Biophysics and Environment.

Accelerator Physics and SR Sources — Ring construction, vacuum and mechanical stability requirements, bending magnets, insertion devices, the emitted spectrum, beam lifetimes etc. This section was planned to give the potential user an idea of the scope of the operation (e.g. why an insertion device cannot be installed over one weekend), the complexity of the problems and the origin of the costs and other factors, which future potential decision makers should be aware of; it also emphasized the properties of the radiation, the distribution of light and its optimum use.

Beamline and Monochromator Design — Beamline design, heat loads, safety features, vacuum and vacuum interlocks, beam splitting, monochromator design and optics, tolerances for components, reflectivities, monochromator throughput, spectral resolution, detectors etc. This section was carefully interfaced with the section on machine physics. The intent was for trainees to get some insight into the limiting factors and also for some tutorial training, e.g. in ray tracing. One should consider that a significant percentage of all "users" may have to contribute to beamline design and construction at some time. Certainly they should know the characteristics of their detectors.

Photo-emission, Electron Emission Diffraction and Holography — Spectrometer characteristics, ARUPS, XPS, resonant PS, Cooper minimum, chemical shifts, variable surface sensitivity, quantitative and qualitative analysis, semiconductor research. Photoelectron and Auger electron diffraction spectra, holographic reconstruction of surface atom images. Tutorial work on analysis of spectra was included.

X-ray Absorption, Spectroscopy, XANES and EXAFS — Both structural, electronic and magnetic properties can be addressed by core level absorption spectroscopy. EXAFS is an

atomic-selective tool to evaluate the local atomic environment. It is extensively used in materials science, chemistry and physics. EXAFS was the object of tutorial work and training in data analysis on personal computers. This part of the course was based on the course which was held in Campinas (Brazil, 1990) and in the two previous ICTP schools.

X-ray Diffraction, Cristallography and Small Angle Scattering — Biophysics and materials science take advantage of these techniques to describe long range and medium range order. Synchrotron radiation brings the tunability of the photon energy which makes resonant scattering possible, atomic-specific, and therefore playing a role analogous to isotopic substitution currently used in neutron scattering.

Present developments deal with the polarization tunability and the abundance of coherent X-rays delivered by the undulators implemented in the machine of the third generation.

An afternoon visit to the ELETTRA laboratory at Sincrotrone Trieste was also part of the programme.

L. Fonda

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	8	
Asia	23	
Europe	12	27
North and Central America	2	2
South America	15	
International Organizations		1
Total	*60*	*30*
Grand Total	***90***	
Directors and Lecturers	26	
Participants	64	
Countries represented	33	
Int'l Organizations represented	1	
Person-months	75.28	
Applications received	181	

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Title: WORKSHOP ON OPTICAL METHODS FOR ENVIRONMENTAL MONITORING OF THE ATMOSPHERE

Dates: 13 - 17 November.

Co-sponsors: University of Trieste.

Directors: Professors G. Denardo (ICTP), N.I. Koroteev (Moscow State University, Russia), N. Kroo (Research Institute for Solid State Physics of the Hungarian Academy of Sciences, Budapest, Hungary), and G. Vannini (University of Trieste).

Purpose: To stimulate scientific cooperation of research groups in Central and Eastern European countries with the University of Trieste and with other institutions at an international level.

Programme:

Lectures:

G. FIOCCO (Universita' degli Studi di Roma 'La Sapienza', Rome, Italy) – Early and Recent Results Using Lidars.

M. SIGRIST (Eidgenossische Technische Hochschule Honggerberg, Zurich, Switzerland) – Perspectives of Laser Photoacoustic Spectroscopy for Air Monitoring.

M. FRANKO (University of Ljubljana, Slovenia) – Phototermal Techniques for Selective Detection of Trace Gaseous Pollutants.

V.E. ZUEV (Institute of Atmospheric Optics, Tomsk, Russia) – Laser Remote Sensing of Meteorological and Ecological Parameters of the Atmosphere.

L. STEFANUTTI (Istituto di Ricerca Sulle Onde Elettromagnetiche, Florence, Italy) – Airborne Polar Experiment.

V. GORDIENKO (Moscow State University, Russia) – Coherent CO_2 Lidars for Measuring Wind Velocity and Atmospheric Turbulence.

S. BÖROCZ (Technical University of Budapest, Hungary) – Remote Detection of Poisonous Gases by Heterodyne LIDAR Techniques.

J. KOLEV (Bulgarian Academy of Science, Sofia, Bulgaria) – LIDAR Investigation of the Aerosol Stratification in Planetary Boundary Layer (over urban area, muntain valley and coastal zone).

L. VALKUNAS (Lithuanian Academy of Sciences, Vilnius, Lithuania) – Optical Methods for Environment Monitoring in Lithuania. Results and Development.

G. PICHLER (University of Zagreb, Croatia) – DFWM and CARS Detection of Gases.

S.S. KHMELEVTSOV (Institute of Experimental Meteorology, Obninsk, Russia) – Stratospheric and Tropospheric Aerosol Monitoring by Laser Sounding as a Part of Global Aerosol Monitoring System for Evaluation of Climate Change.

M. DEL GUASTA (Istituto di ricerca sulle onde elettromagnetiche, Florence, Italy) – Characterization of Tropospheric and Stratospheric Clouds by Means of Lidar.

Seminars:

V.V. Zuev jr. presented by V.E. ZUEV (Institute of Atmospheric Optics, Tomsk, Russia) – Optical Diagnostics of Ozone.

J.C. REYNA ALMANDOS (Centro de Investigaciones Opticas, La Plata, Argentina) – Local and Remote Detection of Atmospheric Gas Pollutants.

L. KLASINC (Rudjer Boskovic Institute, Zagreb, Croatia) – Atmosphere Analysis by Classical Methods.

A. CZITROVSKY (Hungarian Academy of Sciences, Budapest, Hungary) – Complex Measurements of Airborne Dust Pollution within the City of Budapest.

A.A. KOKHANOVSKY (Belarus Academy of Sciences, Minsk, Belarus) – Cloud Optics: Direct and Inverse Problems.

V.V. BARUN (Belarus Academy of Sciences, Minsk, Belarus) – Approximations for Backscattered Signal from Clouds as Applied to Laser Sounding and Vision Problems.

V.C. JHA (Visva-Bharati University, Santiniketan, India) – Morphoclimatic Mechanisms and Their Role in Environmental Degradation Using Satellite Remote Sensing Techniques.

M. GACIC (Osservatorio Geofisico Sperimentale, Trieste, Italy) – Analysis of Seasonal and Interannual Variability of the Sea Surface Temperature Field in the Adriatic Sea from Satellite AVHRR Data.

M. BERTA (Slovak Academy of Sciences, Bratislava, Slovak Rep.) – Use of Optical Waveguides for Monitoring of Gases and Liquids Related to the Environment.

I. OEHME (Karl-Franzens Universität Graz, Austria) – Fiber Optic Sensors for Gaseous Species.

M. MESSEROTTI (Osservatorio Astronomico, Trieste, Italy) – A Digital System for the Optical Monitoring of the Atmosphere in Astronomical Observation.

V.Ya. PANCHENKO (Scientific Research Centre For Technological Laser, Troitsk, Russia) – Infrared and Microwave Spectroscopy of Ozone.
J. VICENIK (Military Research Institute, Liptovsky Mikulas, Slovak Rep.) – Mini CO_2 DIAL System.
G. MANZONI (Università degli Studi di Trieste, Italy) – Space and Time Community and Individual Monitoring of Air Pollution.
M. RATAJ (Polish Academy of Sciences, Warsaw, Poland) – Fourier Transform Infrared Spectrometer for Atmospheric Measurement for Cesar Mission.
A. VESNAVER (Osservatorio Geofisico Sperimentale, Trieste, Italy) – The Null Space Control in the Tomographic Inversion.
T. DINKU (National Meteorological Services Agency, Addis Ababa, Ethiopia) – Rainfall Estimation from METEOSAT Data and its Application in Ethiopia.
T. GASMI (Haut Commissariat à la Recherche, Algiers, Algeria) – Experiments Related to Environment at the ICTP Laser and Optical Fibre Laboratory.
E.R. PULIDINDI (Indian Institute of Tropical Meteorology, Pune, India) – Lidar Monitoring of Aerosols and Gases in the Lower Atmosphere over a Tropical Urban Station in India.
A. JUREWICZ (Polish Academy of Sciences, Warsaw, Poland) – Impact of an Aerosol Layer on Atmospheric Radiation.
A. JUOZAITIS (Lithuanian Academy of Sciences, Vilnius, Lithuania) – Size-spectrometric Investigations of Ambient Aerosol.
J. KADLAK (Military Technical Institute of Protection, Brno, Czech Rep.) – Mobile TEA CO_2 DIAL for Remote Detection of Organic Compounds in the Atmosphere and its Testing.
V. YERSHOV (Russian Academy of Science, St. Petersburg, Russia) – Determination of Atmospheric Refraction Anomalies with the Use of the Infrared Meridian Instrument.

Poster Session.

General Discussion on cooperation of the University of Trieste and ICTP with East and Central Europe.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	7	
Asia	7	
Europe	33	10
South America	1	
International Organizations		1
Total	*48*	*11*
Grand Total	***59***	
Directors and Lecturers	16	
Participants	43	
Countries represented	24	
Int'l Organizations represented	1	
Person-months	15.52	

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Title: ICTP-UN CONFERENCE ON OPTICAL PHYSICS IN SPACE SCIENCE AND TECHNOLOGY

Dates: 20 - 24 November.

Co-sponsors: United Nations Office for Outer Space Affairs (Vienna, Austria).

Directors: Professors S. Chernikov (United Nations Office for Outer Space Affairs, Vienna, Austria) and G. Denardo (ICTP).

Purpose: To present the most recent activities involving the use of satellites for scientific and technological purposes, with special attention to the application of optics in space sciences.

Programme:

F. MERKLE (Carl Zeiss Jena GmbH, Germany) – New technologies for ground and space based astronomical optics.

J. SHAPIRA (Radio Systems Expertise, Haifa, Israel) – Personal satellite communications.

Optics in Telecommunication

G. RONDINELLI (Nuova Telespazio S.p.A., Rome, Italy) – Telespazio activities on small satellite scientific programmes.

A.M. ZIHLIF (University of Jordan, Amman, Jordan) – Shielding of the electromagnetic pollution in space by conductive polymer composites.

F. GRAZIANI (Università di Roma "La Sapienza", Italy) – UNISAT: a microsatellite for educational purposes.

G.O. AJAYI (Obafemi Awolowo University, Ile-Ife, Nigeria) – Some trends in satellite communication.

E. MARCHETTI (Compagnia Generale Telemar, Trieste, Italy) – Practical use of INMARSAT terminal(s).

Remote Sensing

V.C. JHA (Visva-Bharati University, Santiniketan, India) – Application of satellite remote sensing to geomorphological hazards assessement in tropical regions.

A. KOKHANOVSKY (Stepanov Institute of Physics, Minsk, Belarus) – Determination of the effective particle radius of clouds from space: new approach.

T. TADESSE (National Meteorological Services Agency, Addis Ababa, Ethiopia) – Impact of direct reception of satellite data on African Meteorological Service: operational use of NOAA AVHRR and METEOSAT products in Ethiopia.

M.M. DIALLO (Direction National de la Météorologie, Conakry, Guinea) – The application of satellite pictures for synoptical analyse in Western and Central Africa.

P.S. NGWAZIKAZANA (University of Zimbabwe, Harare, Zimbabwe) – Satellite remote sensing in earth sciences: a technology in search of problems to solve? The case of Zimbabwe.

Astronomy

M. MESSEROTTI (Astronomical Observatory of Trieste, Italy) – Astrophysical applications of microsatellites: an evaluation module for solar measurement.

R. HUDEC (Astronomical Institute, Ondrejov, Czech Republic) – X-ray optics for space applications.

N.C. WICKRAMASINGHE (Sri Lanka and University of Wales, Cardiff, UK) – Applications of light scattering theory to identify dust grains in astrophysics.

R. STALIO (CARSO, Trieste, Italy) – IDES, an EUV spectrometer for the measurement of the diffuse cosmic background.

Remote Sensing

A. NARAYANA SWAMY (Andhra University, Waltair, India) – Status of optical and microwave satellite remote sensing for runoff forecast in high mountainous catchments.

L.A. FRULLA (Centro Argentino de Estudios de Radiocomunicaciones y Compatibilidad Electromagnética/Itba, CAERCEM, Buenos Aires, Argentina) – Applications of radiometric corrections for optical remote sensing data.

GUOREI ZHANG (Institute of Space Machine & Electricity, Beijing, P.R. China) – Image quality under the influence of gradient temperature in space.

E.E. EKUWEM (Meteorological Research Institute, Lagos, Nigeria) – Optical instruments in satellite remote sensing.

G. STANCALIE (Nat. Inst. of Meteorology & Hydrology, Bucharest, Romania) – Water resources inventory and monitoring by remote sensing techniques in Romania.

F. SVELTO (Agenzia Spaziale Italiana, Rome, Italy) – Laser technologies utilization aboard space platforms for remote sensing, communication and instrumentation.

Astronomy

A. TREVES (International School for Advanced Studies, Trieste, Italy) – Multifrequency observations of active galactic nuclei.

P. SREEKUMAR (NASA, Greenbelt, MD, USA) – Gamma ray sky as seen by EGRET on board the Compton Gamma Ray Observatory Satellite.

G.V. COYNE (Specola Vaticana, Vatican City State) – Astrophysics with new infrared and ultraviolet cameras on the Hubble space telescope.

M. HACK (Università degli Studi di Trieste, Italy) – The future of ultraviolet astronomy from satellites.

E.G. TANZI (Istituto di Fisica Cosmica "G. Occhialini", Milan, Italy) – The spectrum-UV mission: an international ultraviolet observatory.

Remote Sensing

G. HOANG VIET (Nat. Council for Space Tech. Appl., Hanoi, Vietnam) – Activities in research and applications of remote sensing in Vietnam.

S.C. CHAKRAVARTY (Indian Space Research Organization, Bangalore, India) – Optical remote sensing of the atmosphere over Indian region.

R. NARAYANAN (Physical Research Laboratory, Ahmedabad, India) – Optical remote sensing of the upper atmosphere during daytime using ground-based spectrophotometry.

DAYUAN YAN (Beijing Institute of Technology, China) – A solar calibration device for remote sensing systems.

T. DINKU (National Meteorological Services Agency, Addis Ababa, Ethiopia) – Spacial and temporal distribution of convective clouds over Ethiopia from satellite data.

Demonstration of the programme "Optika".

M. ZORAN (Institute of Optoelectronics, Bucharest, Romania) – Processing and analysing of satellite data in visible, infrared and microwave region of electromagnetic spectrum for risk assessment in nuclear power plant area environment.

G.B. PALMERINI (Università di Roma "La Sapienza", Italy) – Satellite constellations for telecommunication services.

L. BONINO (Alenia Spazio, Turin, Italy) – Small satellite system approach for multimission payloads.

C. GIRARD (International Telecommunication Union, Geneva, Switzerland) – SPACECOM Project — A new model of partnership inside the ITU development sector to promote a wide-spread

application of satellite communications technology in developing countries.

Conference discussion – Development of optical sensors technology for astronomy, remote sensing and space communications: international cooperation, participation of developing countries.

Astronomy

M. PARTHASARATHY (Indian Institute of Astrophysics, Bangalore, India) – Evolution of low and intermediate mass stars: the observational evidence from the infrared astronomical satellite (IRA) and International Ultraviolet Explorer (IUE).

V. YERSHOV (Pulkovo Observatory, St. Petersburg, Russia) – Submilliarcsecond astrometry with the Struve satellite.

A. CICUTTIN (ICTP Microprocessor Laboratory) – The new generation of gamma ray telescopes.

F. ABDEL BADIE MAHMOUD (Inst. of Astro. & Geophys., Cairo, Egypt) – Activity of astronomy in Egypt and Kottamia observatory in the past and at present.

V.V. BARUN (Institute of Physics, Minsk, Belarus) – One of the possible reasons for improving visibility of earth's objects from space.

R. HUDEC (Astronomical Institute, Ondrejov, Czech Republic) – Optical ground based network for gamma ray satellites.

Visit to Centre for Advanced Research in Space Optics (CARSO, Trieste).

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	11	
Asia	12	1
Europe	6	18
North and Central America		1
South America	3	
International Organizations		1
Total	*32*	*21*
Grand Total	***53***	
Directors and Lecturers	1	
Participants	52	
Countries represented	23	
Int'l Organizations represented	1	
Person-months	11.78	

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MISCELLANEOUS

Title: DIGITAL COMMUNICATIONS AND COMPUTER NETWORKING (Scientific Computer Section, SCS)

Dates: All year.

Head: Dr. A. Nobile (ICTP).

Report: In 1995, the focus of the activities of the Scientific Computer Section was on the consolidation of the network infrastructure and the increase of the number of working places available to ICTP scientists and visitors.

The LAN of the ICTP was completely re-built and it is now based on a structured cabling system carrying Ethernet; switched Ethernet technology and a few 100MB fast Ethernet connections are used to increase the bandwidth available.

The main services were re-organized basing them on a few redundant servers with automatic failover capabilities. The disk space available to the users was expanded to above 20 Gbytes, and the backup facilities, based on Exabyte 8mm cartridges technology, were expanded accordingly and tuned for increased reliability.

The main computing facilities were expanded through the purchase of another couple of IBM R6000 computers equipped with 256 Mbytes of RAM and 4 Gbytes of disk each. The processing power available to scientists for large computations has therefore doubled.

A number of fast SunSparc20 workstations were added to the network, and are available for less demanding computations. In addition, about 15 SunSparc5 workstation were purchased by the Research Groups. Most of the resident scientists are now equipped with individual workstations. About 40 new high end PC's running both MS-Windows and Linux became available for general use in all Computer Labs of the ICTP. A few CD-ROM readers were connected to the PC's. In fact, the decision to make Linux available on all the PC's in the ICTP and to support it as one of our standard platforms has been the most relevant change in our software environment in the year.

From the software point of view, the migration to the Solaris 2.x operating system proved to be quite difficult and labour intensive. The porting of the last services should be completed in early 1996.

Together with the migration to the new operating system, other basic software packages were replaced or enhanced:

- New compilers (Fortran 90) were introduced, and several mathematical libraries (including part of the CERN library, the SLATEC library and a few others) were ported to work with them. This work is expected to be re-examined during 1996, in view of the installation of new compilers.
- The number of licenses for some of the computational algebra packages was substantially increased.
- Many public domain programs, including the C compilers and the mail utilities, were upgraded.

In the field of information systems, the migration of the ICTP World Wide Web server to Solaris 2.x was carried out. The server was configured to be able to handle searches in the information base like ICTP activities, phone book, etc. With this change, the ICTP gopher server started to be phased out. A set of mailing lists was established for the distribution of general information to the ICTP/TWAS staff and scientists. Another mailing list distributing information on the current preprints issued at ICTP become operative and open to free subscription world-wide. The in-house documentation was updated three times along the year, to follow the upgrade of the related software.

Finally, extensive analysis and test of both commercial and public domain general purpose visualization software (for X-Windows environment), such as AVS, IRIS explorer, IBM Data explorer and Khoros was carried out in view of the establishment of a graphic and visualization resource in 1996.

The SCS continued to support the computational resources of the Microprocessor Lab and of the ICTP Library.

It provided substantial support to the start of the new ICTP activity related to the development of communications in the Third World Countries.

During 1995 the network connection of the ICTP (which is based on the Italian Academic Network) with the world, exhibited serious capacity problems, in particular in relation with the connections with North America. The ICTP SCS closely cooperated with the other institutions in Trieste in tracking the problem and urging the organizers of the Italian National Academic Network (GARR) to take action. A final decision on this topic — to substantially increase the capacity of both the Italy-USA and European lines, and to move the connection points to better serviced locations — was reached by the Italian Academic Networking Organization near the end of the year. The implementation of these decisions is expected to start in phases at the beginning of 1996 and be completed before the Autumn.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	2	
Asia	3	
Europe	1	1
South America	1	
International Organizations		1
Total	*7*	*2*
Grand Total	***9***	
Countries represented	7	
Int'l Organizations represented	1	
Person-months	26.34	

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Title: OTHER RESEARCH

Dates: Throughout the year.

Purpose: To allow scientists wishing to avail themselves of the Centre's facilities (library and computers) and of the presence of ICTP consultants and other experts to carry out independent research in periods when no activity is scheduled in their fields of interest.

Figures also include short-term visitors coming for organizational activities only.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	58	
Asia	36	1
Europe	28	19
North and Central America	2	4
South America	8	
International Organizations		9
Total	*132*	*33*
Grand Total	***165***	

Countries represented	56
Int'l Organizations represented	4
Person-months	250.58
Applications received	166

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Title: SCIENCE, HIGH TECHNOLOGY AND DEVELOPMENT

Dates: Throughout the year.

Organizer: Professor H.R. Dalafi (ICTP).

Purpose: To increase the awareness of scientists of the role of physics in social and economic development, and to inform Third World scientists of potential sources of assistance for physics research and its applications to the development needs of their countries.

Programme:

X.F. CARELSE (Univ. of Zimbabwe) – Making your own science laboratory equipment.

J.G. ROEDERER (Univ. of Alaska, Fairbanks, USA) – North-South co-operation in international atmospheric programmes.

M.S. AYATOLLAHI (Resident Representative of the Islamic Republic of Iran to IAEA, Vienna, Austria) – Energy and sustainable development.

H. SCHOPPER (CERN, Geneva, Switzerland) – I: From quarks to medicine. Basic research and technology. II: The unity of micro- and macrocosm.

N. KOULBERG (CERN, Geneva, Switzerland) – International co-operation at CERN.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Asia	1	
Europe		1
North and Central America		1
International Organizations		2
Total	*1*	*4*
Grand Total	***5***	
Countries represented	3	
Int'l Organizations represented	1	
Person-months	1.07	

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Title: FOURTH ICTP-URSI-ITU (BDT) COLLEGE ON RADIOPROPAGATION: PROPAGATION, INFORMATICS AND RADIOCOMMUNICATION SYSTEM PLANNING

Dates: 30 January - 3 March.

Co-sponsors: Union Radio-scientifique Internationale (URSI), Telecommunications

Development Bureau of the International Telecommunications Union (ITU-BDT, Geneva, Switzerland).

Directors: Professors S.M. Radicella (ICTP) and J. van Bladel (University of Ghent, Belgium).

Report: The fourth of a sequence of Colleges on Radiopropagation was oriented towards the training needs related to radiocommunication system planning, including the modern informatic technology for the same purpose. The program was carefully structured keeping in mind these needs; the last two weeks of the College were devoted entirely to computer exercises in the Laboratory on Informatics available for the College.

During a final open discussion the most general opinion was that this series of Colleges should continue almost with the same structure of the Fourth College, but with computer exercises organised after each group of topical lectures. It was also pointed out that the convenience of maintaining the participants profile as in this College where 30% of them belonged to telecommunication services technical professionals and the other 70% to research centres and universities.

Both URSI and ITU have contributed financially and also by providing lecturers.

Programme:

1. Introductory Course (45 hours).
   - 1.a. Electromagnetics [J. VAN BLADEL, University of Ghent, Belgium].
   - 1.b. Computer Techniques (ICTP expert).
   - 1.c. Informatics for Radiocommunications [F. GARDIOL, Ecole Polytechnique Fédéral de Lausanne, Switzerland].
2. Propagation information for modern HF systems planning (4 hours) [P. BRADLEY, Rutherford Appleton Laboratory, Didcot, UK].
3. Propagation information for VHF-UHF systems planning (4 hours) [L. BARCLAY, Radiocommunications Agency, London, UK].
4. Climatic information for satellite communication planning (4 hours) [G.O. AJAYI, Obafemi Awolowo University, Ile-Ife, Nigeria].
5. Noise, interference and EMC in modern radiocommunication system planning (4 hours) [P. DEGAUQUE, Univ. des Sciences et Techniques, Villeneuve d'Ascq, France].
6. Digital signal processing in radiocommunications (4 hours) [J.G. LUCAS, Univ. of Western Sydney, Kingswood, Australia].
7. Mobile and personal communications system planning (4 hours) [J. SHAPIRA, Qualcomm, Haifa, Israel].
8. Biological effects of electromagnetic waves from radiocommunication systems (4 hours) [P. BERNARDI, Univ. "La Sapienza", Rome, Italy].
9. Radio spectrum management for system planning (4 hours) [R. STRUZAK, CCIR-ITU, Geneva, Switzerland].
10. Laboratory on Informatics for Radiocommunications [K. Hughes, J.G. Lucas, P. Degauque and R. Struzak].
    - 10.a. Signal processing.
    - 10.b. Noise, Interference and EMC.
    - 10.c. Propagation predictions.
    - 10.d. Spectrum management.
    - 10.e. Mobile communication network planning.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	13	
Asia	13	2
Europe	9	10
Indonesia and Oceania	1	1
North and Central America	2	
South America	3	
Total	*41*	*13*
Grand Total	***54***	
Directors and Lecturers	29	
Participants	25	
Countries represented	30	
Person-months	58.74	
Applications received	113	

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Title: FIRST BOLIVIAN COURSE ON COMPUTERIZED DATA ACQUISITION TECHNIQUES, held in La Paz, Bolivia.

Dates: 13 - 25 February.

Co-sponsors: ICTP, United Nations University (UNU, Tokyo, Japan), and Centro Internacional de Física (CIF, Santa Fe de Bogotá, Colombia).

Director: Professor A. Colavita (ICTP).

Purpose: To cover techniques needed for data acquisition using computers.

Report: The Course structure was aimed at providing the participating scientists with the skills necessary to acquire and process experimental data using computers. It covered: basic digital design; programmable logic devices such as PALs and FPGAs; the hardware and software of the MC6809 taken as an archetypical microprocessor; DSP architecture and signal processing. The Course assigned about equal time between theory and laboratory practice. The laboratory used the Rosy stations designed at CAN and that were donated seven years ago to CIF. Personal computers were used for the digital signal processing exercises.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Asia	1	
Europe		1
South America	56	
Total	*57*	*1*
Grand Total	***58***	
Directors and Lecturers	2	
Participants	56	
Countries represented	7	
Person-months	22.63	

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Title: SECOND WORKSHOP ON RURAL COMMUNICATIONS IN DEVELOPING COUNTRIES

Dates: 6 - 10 March.

Co-sponsors: Union Radio-Scientifique Internationale (URSI), International Telecommunications Union (ITU, Geneva, Switzerland).

Directors: Professor S.M. Radicella (ICTP) and Mr. J. Jipguep (ITU).

Topics: Economic impact of rural communications in developing countries.
Alternative solutions for rural telecommunication systems.
Propagation information for rural radiocommunications.
Reports on countries' experience in rural communications.

Report: The second of a series of Workshops on Rural Communications was particularly oriented to the presentation and discussion of the technical, economic and political aspects of rural communications. Leading officials of the International Telecommunication Union (ITU) presented the view of the Union, and three round table discussions gave the opportunity for a fruitful exchange of opinions on the subject.

In addition, technical descriptions of the systems now available were presented and the national status of rural communications in seven developing countries from the Americas, Asia and Africa were analysed by representatives of those countries. It must be noted that the Telecommunication Development Bureau of ITU have indicated the importance of the Workshop and the good results achieved. Both URSI and ITU have contributed financially and also by providing lecturers.

Programme:

J. JIPGUEP (ITU) – Economic impact of rural communications in developing countries (2 lectures).

G.O. AJAYI (Obafemi Awolowo University, Ile-Ife, Nigeria) – Rural communications in Nigeria (2 lectures).

M.V. PITKE (Tata Inst. of Fundamental Res., Bombay, India) – Rural communications in India (4 lectures).

T.T. DO (Dept. General of Posts and Telecommunications, Hanoi, Vietnam) – Rural communications in Vietnam.

D.O. OMINGO (Kenya College of Communications Technology, Nairobi, Kenya) – Rural communications in Kenya.

V.K. SHARMA (Indian Inst. of Technology, New Delhi, India) – Photovoltaic for telecommunication services in rural areas of developing countries.

G. CAYLA (TRT Philips, Le Plessis-Robinson, France) – Rural communication systems technologies and planning (3 lectures).

D. STAGLIANO (ITU) – Telecommunication development gap and the ITU Buenos Aires Action Plan.

R.G. STRUZAK (CCIR-ITU, Geneva, Switzerland) – The Advanced Rural Telephone Systems (ARTS).

P.H. LOBO (Ministerio das Comunicaçoes, Brasilia, Brazil) – Rural communications in Brazil.

J.R. ROBLES GONZALEZ (Univ. Nacional Autónoma de Honduras, Tegucigalpa, Honduras) – Rural communications in Honduras.

V.E. OCHAVE Jr. (Advanced Science and Technology Inst., Quezon City, Philippines) – Rural communications in the Philippines.

Round Table Discussion 1: Political and economic aspects or rural communications, Rapporteur: G.O. Ajayi.

Round Table Discussion 2: Technologies and investments for integrated rural development,

Rapporteur: M.V. Pitke.
Round Table Discussion 3: Concluding remarks, Rapporteur: J.R. Robles Gonzalez.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	14	
Asia	15	1
Europe	9	6
Indonesia and Oceania	1	
North and Central America	2	
South America	3	
Total	*44*	*7*
Grand Total	***51***	
Directors and Lecturers	7	
Participants	44	
Countries represented	27	
Person-months	9.12	
Applications received	108	

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Title: SEMINAIRE SUR LE SYSTEME DE SIGNALISATION CCITT No. 7 A L'INTENTION DES PAYS FRANCOPHONES

Dates: 20 - 24 March.

Co-sponsors: Telecommunications Development Bureau of the International Telecommunications Union (ITU-BDT, Geneva, Switzerland).

Directors: Professors M. Cherif (ITU) and S.M. Radicella (ICTP).

Purpose: To discuss the development of radiocommunication services in French-speaking African countries.

Programme:
M. VAN DEN BROECK (Belgacom, Brussels, Belgium) – Partie transfert de message (MTP) niveau 3 (2 leçons).
M. VAN DEN BROECK – Partie contrôle de connexion de la Signalisation (SCCP); Possibilités de transaction (TCAP).
M. VAN DEN BROECK – Introduction aux aspects du réseau SS7 + questions sur MTP/SCCP/TCAP.
M. MANSART (CNET-PAA/CER, Issy les Monlineaux, France) – Partie utilisateur RNIS (ISUP) (2 leçons).
M. ALLAERT (Belgacom, Brussels, Belgium) – Réseau Belge.
M. MANSART – Réseau Français.
M. MANSART – Interfonctionnement avec le système R2 et questions ISUP.
M. ALLAERT – Partie application opération et maintenance (OMAP) (2 leçons); exemple Belge et questions sur OMAP.
M. ALLAERT – Appareils de test.

M. ALLAERT – Appareils de test: démonstration sur PC et questions.

Discussion sur les différentes situations en Afrique (Messrs. ALLAERT, VAN DEN BROECK et MANSART).

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	22	
Europe		4
South America	1	
Total	*23*	*4*
Grand Total	***27***	
Directors and Lecturers	5	
Participants	22	
Countries represented	22	
Person-months	7.42	
Applications received	33	

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Title: WORKSHOP ON TELEMATICS

Dates: 2 - 20 October.

Co-sponsors: United Nations University (Tokyo, Japan).

Directors: Professors M. Periasamy (C-Dot Telecom Research Centre, Bangalore, India) and M.V. Pitke (Tata Institute of Fundamental Research, Bombay, India).

Purpose: To focus on the fundamental aspects of communications and computer technologies and their role in the present and the evolving information networks of the future.

Programme:

M. PERIASAMY (C-Dot Telecom Research Centre, Bangalore, India) – Switching Techniques (3 lectures).
A.S. INDURUWA (Univ. of Moratuwa, Sri Lanka) – Digital Communication (3 lectures).
R. KARNAD (Five-D Electronic Technical Services, Bangalore, India) – Telephony Electronics (2 lectures).
S.K. MURTHY (C.D.A.C. Project Cell, New Delhi, India) – Digital Signaling Processing (2 lectures).
A. NOBILE (ICTP) – Internet.
M.V. PITKE (Tata Institute of Fundamental Research, Bombay, India) – Integration of Telephone, Computer & Television.
V. PALESTINI (Centro Studi e Laboratori Telecomunicazioni, CSELT, Turin, Italy) – Digital Mobile (2 lectures).
M. PERIASAMY (C-Dot Telecom Research Centre, Bangalore, India) – Switching software projects (2 lectures).
J. GROMPONE (Interfase Ltd., Montevideo, Uruguay) – Software Techniques (3 lectures).
A.S. INDURUWA (Univ. of Moratuwa, Sri Lanka) – No. 7 Signalling.
M. OMOLOGO (Istituto per la ricerca scientifica e tecnologica, Povo, Italy) – Speech Processing

(2 lectures).

G. MARONE (Centro Studi e Laboratori Telecomunicazioni, CSELT, Turin, Italy) – Fibre Optics (2 lectures).

G.P. BALBONI (Centro Studi e Laboratori Telecomunizazioni, CSELT, Turin, Italy) – ATM/Broadband Switching (2 lectures).

S. PITRODA (Worldtel, Downder Grove, Ill., USA) – Telecom and Development.

J. VALERDI (International Data Messages, Chula Vista, CA, USA) – Satellite Communication (3 lectures).

M. PERIASAMY (C-Dot Telecom Research Centre, Bangalore, India) – Intelligent Network.

H. HASHEMI (Sharif University of Technology, Tehran, Iran) – Cellular Mobile (3 lectures).

F. IVANEK (Communications Research, Palo Alto, CA, USA) – Wireless Communications (2 lectures).

C.S. ANG (3 Ss24/7, Petaling Jaya, Malaysia) – Distributed Multimedia at Cambridge.

M.V. PITKE (Tata Institute of Fundamental Research, Bombay, India) – ATM Chip Set.

C.S. ANG (3 Ss24/7, Petaling Jaya, Malaysia) – Cross Development of Embedded Systems.

M.V. PITKE (Tata Institute of Fundamental Research, Bombay, India) – Computer Telephony & Television.

S. RADICELLA (ICTP) – Planning of Small Scale Communication Networks in Developing Countries.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	12	
Asia	29	
Europe	11	6
North and Central America	3	3
South America	4	
International Organizations		1
Total	*59*	*10*
Grand Total	***69***	
Directors and Lecturers	23	
Participants	46	
Countries represented	34	
Int'l Organizations represented	1	
Person-months	45.97	
Applications received	204	

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DIPLOMA COURSE

Purpose: To provide young, promising graduates in physics or mathematics (mainly from developing countries) with post-graduate training suitable for pursuing teaching and research work in the field.

The minimum qualification for applicants is a degree equivalent to an M.Sc. (or an exceptionally good B.Sc.) in physics or mathematics.

Statistical details are based on the solar year (January to December), and not on the academic year (i.e., October 94-September 95, October 95-September 96).

DIPLOMA COURSE IN CONDENSED MATTER PHYSICS

Co-ordinator: Professor S. Shenoy (University of Hyderabad, India, and ICTP).

Academic year 1994-95, Second term: 3 January – 29 September 1995 (Programme started on 1 October 1994).

Topics:
Electron gas.
Magnetism.
Nonlinear dynamical systems.
Phases in quantum mechanics.
Quantum liquids.
Quasi 1-dimensional systems and electron correlations.
Superconductivity.
Surface physics.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	3	
Asia	8	
Europe	4	2
Indonesia and Oceania	1	
South America	1	
Total	*17*	*2*
Grand Total	***19***	
Directors and Lecturers	9	
Participants	10	
Countries represented	15	
Person-months	98.27	
Applications received	101	

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Academic year 1995-96, First term: 1 September – 22 December 1995 (Programme continues until August 1996).

Topics: Many-body theory, Part 1.
Semiconductors.
Statistical mechanics.
Symmetry, electron bands and phonons.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	2	
Asia	6	
Europe	3	3
Total	*11*	*3*
Grand Total	***14***	
Directors and Lecturers	4	
Participants	10	
Countries represented	12	
Person-months	37.84	
Applications received	114	

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DIPLOMA COURSE IN HIGH ENERGY PHYSICS

Co-ordinator: Professor F. Hussain (ICTP).

Academic year 1994-95, Second term: 3 January - 29 September 1995 (Programme started on 1 October 1994).

Topics: Lie groups and Lie algebras.
Quantum field theory.
The standard model.
Beyond the standard model.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	2	
Asia	6	
Europe	1	1
North and Central America	1	
South America	1	
International Organizations		3
Total	*11*	*4*
Grand Total	***15***	

Directors and Lecturers	5
Participants	10
Countries represented	11
Int'l Organizations represented	1
Person-months	96 47
Applications received	70

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Academic year 1995-96, First term: 1 September – 22 December 1995 (Programme continues until August 1996).

Topics: General relativity.
Introduction to Lie groups and Lie algebras.
Quarks and leptons.
Quantum electrodynamics: introduction to quantum field theory.
Relativistic quantum mechanics.

Statistical Details

Scientists from	***Dev. C.***	***Adv. C.***
Africa	1	
Asia	5	
Europe	2	2
North and Central America	2	
South America	1	
International Organizations		3
Total	*11*	*5*
Grand Total	***16***	
Directors and Lecturers	5	
Participants	11	
Countries represented	11	
Int'l Organizations represented	1	
Person-months	47.62	
Applications received	91	

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DIPLOMA COURSE IN MATHEMATICS

Co-ordinator: Professor C. Chidume (University of Nigeria, Nsukka, Nigeria, and ICTP).

Academic year 1994-95, Second term: 3 January – 29 September 1995 (Programme started on 1 October 1994).

Topics: Algebraic geometry.
Algebraic topology.

Differential geometry.
Iteration theory in the unit disc.
Monotone-type operators for PDE.
Nonlinear operator theory.
Ordinary differential equations.
Partial differential equations.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	6	
Asia	4	
Europe	1	5
Total	*11*	*5*
Grand Total	***16***	
Directors and Lecturers	6	
Participants	10	
Countries represented	8	
Person-months	45.13	
Applications received	93	

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Academic year 1995-96, First term: 1 September – 22 December 1995 (Programme continues until August 1996).

Topics: Abstract algebra.
Functional analysis.
Point-set topology.
Real analysis.

Statistical Details

Scientists from	*Dev. C.*	*Adv. C.*
Africa	6	
Asia	3	
Europe	4	5
North and Central America		1
Total	*13*	*6*
Grand Total	***19***	
Directors and Lecturers	9	
Participants	10	
Countries represented	10	
Person-months	96.49	
Applications received	81	

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LONG-TERM SCIENTIFIC VISITORS

This section shows data on scientists who were invited to take part in the research for 3 months and longer in 1995.

(A) POST-DOCTORAL FELLOWS

Post-Doctoral Fellows are young scientists invited for a period of 1 year (+1 year) to carry out independent research and/or avail of guidance by the senior scientists within the relevant research group.

Table 1.a

Post-Doctoral Fellows by Field of Activity

Field	Scientists	% vs. total	P-Months	% vs. total	Preprints
Condensed matter physics	20	51.28%	141.25	44.90%	8
High & interm. energies	13	33.33%	127.55	40.54%	27
Mathematics	6	15.38%	45.82	14.56%	4
TOTAL	**39**		**314.62**		**39**

Table 1.b

Post-Doctoral Fellows by Geographical Area

Areas	Scientists		Person-months	
	Dev.	Adv.	Dev.	Adv.
Africa	1	0	2.53	0
Asia	13	0	102.88	0
Europe	2	6	7	42.77
North and Central America	0	4	0	37.71
South America	6	0	49.6	0
International Organizations	0	7	0	72.13
TOTAL	22	17	162.01	152.61
GRAND TOTAL	**39**		**314.62**	

(B) OTHER LONG-TERM VISITORS

Table 2.a

Long-Term Visitors by Field of Activity

Fields of interest	Scientists	% vs. total	Person-months	% vs. total	Preprints
Research:					
Condensed matter physics	35	15.70%	202.72	14.84%	9
High & interm. energies	66	29.60%	388.17	28.41%	63
Mathematics	59	26.46%	357.00	26.13%	30
Structure of Earth	21	9.42%	143.56	10.51%	19
Digital communication	6	2.69%	32.45	2.37%	2
Other	18	8.07%	114.07	8 35%	1
Laboratories:					
Microprocessors	5	2.24%	22.51	1.65%	0
High T_c	3	1.35%	36.00	2.63%	0
Laser	6	2.69%	38.08	2.79%	0
Aeronomy & Radioprop.	4	1.79%	31.79	2.33%	0
TOTAL	**223**		**1366.35**		**124**

Table 2.b

Long-Term Visitors by Geographical Area

Areas	Scientists		Person-months	
	Dev.	Adv.	Dev.	Adv.
Africa	39	1	199.7	7.96
Asia	61	1	353.26	6.97
Europe	54	29	292.99	229.57
North and Central America	6	4	28.6	26.27
Indonesia and Oceania	1	0	7.99	0
South America	12	0	82.46	0
International Organizations	0	15	0	130.58
TOTAL	**173**	**50**	**965.00**	**401.35**
GRAND TOTAL	**223**		**1366.35**	

ASSOCIATE MEMBERS AND FEDERATION ARRANGEMENTS

(A) ASSOCIATE MEMBERS

The ICTP Associateship Scheme, which currently includes: REGULAR ASSOCIATES, SENIOR ASSOCIATES, HONORARY ASSOCIATES, GROUP ASSOCIATES and JUNIOR ASSOCIATES was set up to allow scientists of a good research level, from and working in developing countries, to remain regularly in contact with the most modern aspects of their scientific fields through visits to the ICTP, and to help them to develop scientific communities in their home countries, with specific reference to local needs.

The enormous number of applications received and the quality of the candidates for the Associate Membership Scheme are indicative of the importance of the Scheme which for so many scientists from developing countries may represent the only contact with the main developments of modern research.

While at the ICTP, Associates have always found the scientific stimulus required for maintaining their own research standard and for inspiring their young colleagues in their own countries. They are given opportunities to attend meetings, to have discussions with experts in their field and attend international conferences relevant to their research interests. Several preprints are produced by the Associates during their visits, and submitted to international scientific journals for publication.

Honorary Associates are nominated by the ICTP as a gesture of its appreciation for the close links of collaboration with certain Associates who have acquired a position of prestige in their country. This appointment implies no financial commitment from the ICTP.

Regular Associates

Regular Associates are entitled to spend from six weeks to ninety days at the ICTP, three times in the six-year period of their appointment, generally at a time of their own choosing. However, they are encouraged to arrange their visits during periods when relevant activities in their research subject are organized at the ICTP. For these visits the ICTP provides their fare and a living allowance, while their home institution is expected to grant paid leave of absence. While at the ICTP, Associates either carry out their own research work or work in collaboration with other scientists or groups, participating in workshops, courses/colleges or conferences.

Group Associates

A group of six scientists belonging to the same scientific institution is granted one or two Associateship privileges, each entailing three Associateship visits in a six-year period.

Tables 1, 2 and 3show statistical data on Regular and Group Associates together.

Table 1

Breakdown by geographical areas

Geographical areas	Associates		Visits			
	#	% vs. total	Visits	% vs. total	P-Months	% vs. total
Africa	142	30.34	83	39.90	194.27	45.92
Asia	195	41.66	73	35.09	145.18	33.79
Europe	44	9.40	20	9.61	38.07	8.62
Indonesia and Oceania	1	0.21	0	0.00	0	0.00
North & Central America	23	4.91	9	4.32	14.99	3.48
South America	63	13.46	23	11.05	37.05	8.62
TOTAL	**468**		**208**		**429.56**	

Table 2

Breakdown by fields of activity

Fields	Associates		Visits	
	#	%	#	%
Condensed Matter	115	24.57	58	27.88
High & Intermediate Energies	114	24.35	49	23.55
Mathematics	86	18.37	33	15.86
Physics and Energy	22	4.70	14	6.73
Physics of the Environment	50	10.68	23	11.05
Living State	38	8.11	15	7.21
Applied Physics	28	5.98	11	5.28
Other	15	3.20	5	2.40
Total	**468**		**208**	

Table 3

Summary

1.	Regular Associates in 1995	468
2.	Regular Associates in 1994	428
3.	Appointments expired at the end of 1994	60
4.	New appointments starting in 1995	68
5.	Extensions and renewals starting in 1995	35
6.	Member states represented in 1995	79
7.	Regular A. visiting ICTP in 1995 from 58 countries	208
8.	Person-months	429.56
9.	Average duration of stay	2.00 person-months or 60 days
10.	Preprints produced	104

Senior Associates

Some former Regular Associates who have acquired international scientific status and authority in their home countries, may be appointed Senior Associates upon recommendation of the Scientific Council. The ICTP places at their disposal the sum of It. Lire 8,000,000 to be spent during the six-year period of their appointment.

Table 4
Senior Associates — Summary

1.	Senior Associates in 1995	93
2.	Senior Associates end of 1994	94
3.	Appointments expired at the end of 1994	10
4.	New appointments starting in 1995	10
5.	Extensions and renewals starting in 1995	0
6.	Member states represented in 1995	30
7.	Senior A. visiting ICTP in 1995 from 13 countries	18
8.	Person-months	12.95
9.	Average duration of stay	0.72 person-months = 22 days
10.	Preprints produced	7

Table 5
Senior Associates — Breakdown by geographical areas

Geographical Areas	Associates		Visits			
	#	% vs. total	Visits	% vs. total	P-Months	% vs. total
Africa	9	9.67	3	16.66	1.78	13.74
Asia	53	56.98	10	55.55	6.90	53.28
Europe	5	5.37	3	16.66	2.99	23.08
Indonesia & Oceania	0	0.00	0	0.00	0.00	0.00
North & Central America	5	5.37	0	0.00	0.00	0.00
South America	21	22.58	2	11.11	1.28	9.88
Total	**93**		**18**		**12.95**	

Table 6
Senior Associates — Breakdown by fields of activity

Fields	Associates		Visits	
	#	%	#	%
Condensed Matter	28	30.10	1	5.55
High & Intermediate Energies	39	41.93	12	66.66
Mathematics	12	12.90	1	5.55
Physics and Energy	6	6.45	2	11.11
Physics of the Environment	1	1.07	0	0.00
Living State	4	4.30	2	11.11
Applied Physics	3	3.22	0	0.00
Total	**93**		**18**	

Junior Associates

Young, promising Third World participants in ICTP activities who come from geographically isolated areas, may be appointed Junior Associates. They are entitled to receive scientific literature up to the value of It. Lire 700,000 each year for the four-year period of their appointment.

Table 7

Junior Associates — Summary

1.	Junior Associates in 1995	46
2.	Junior Associates in 1994	54
3.	Appointments expired at the end of 1994	54
4.	New appointments starting in 1995	46
5.	Extensions and renewals starting in 1995	0
6.	Member states represented in 1995	37

Table 8

Junior Associates — Breakdown by geographical areas

Geographical Areas	Associates	% vs. total
Africa	21	45.65
Asia	16	34.78
Europe	3	6.52
Indonesia and Oceania	0	0.00
North & Central America	4	8.69
South America	2	4.34
TOTAL	**46**	

Table 9
Junior Associates — Breakdown by field of activity/subfield

Fields	Subfields	Associates	% vs. total
Condensed Matter	Atomic Physics	1	2.17
	Materials Science	3	6.52
	Solid State	13	28.26
High & Intermediate Energies	High Energy	5	10.86
	Plasma Physics	2	4.35
Mathematics	Algebra	1	2.17
	Mathematical Physics	1	2.17
	Analysis	1	2.17
	Applicable Mathematics	1	2.17
	Differential Equations	1	2.17
	Geometry	1	2.17
Physics and Energy	Non-Conventional Energy	3	6.52
Physics of the Environment	Geophysics	2	4.35
	Physics of the Oceans	1	2.17
Physics of the Living State	Biophysics	2	4.35
	Neurophysics	1	2.17
Applied Physics	Instrumentation Physics	2	4.35
	Lasers	4	8.69
	Physics in Industry	1	2.17
TOTAL		**46**	

(B) FEDERATION ARRANGEMENTS

Federation Arrangements are agreements signed by the ICTP and a scientific institute (Federated Institute) in a Third World country. This enables the Institute to send junior scientists to the ICTP for a total of 30 to 75 person-days per calendar year, on a cost-sharing basis. While living expenses are always covered by the ICTP, travel expenses are either covered by the Federated Institute or shared with the ICTP.

The Federation Arrangement Scheme gives the opportunity to junior scientists from developing countries to participate in the ICTP's scientific programmes. Their participation is proposed by the Federated Institute and approved by the ICTP.

Presently there are five different standard types of Federation Arrangements depending upon geographical areas.

Table 1

Standard Arrangements

1. Arrangements proposed in 1995	211
2. Arrangements signed	168
3. Arrangements utilized	154
4. Scientists at ICTP in 1995 from Federated Institutes	307
5. Person-months	240.69
6. Countries represented for the visits	52
7. Total person-months allocated for the agreements used	247.36
8. Person-months utilization rate for the 154 Arrangements used	97.30

Table 2
Special Arrangements

Institution	Visitors	Days	Person-months
1. Kuwait Foundation for the Adv. of Science	20	495	16.27
2. Kuwait University	10	237	7.80
TOTAL	**30**	**732**	**24.07**

Table 3
Summary

Type of agreement	Visitors	Person-months
Standard	307	240.69
Special	30	24.07
TOTAL	**337**	**264.76**

Note - 264.75 person-months represent 5.59% of the total person-months of ICTP activities.

TRAINING AND RESEARCH AT ITALIAN LABORATORIES (TRIL)

Dates: Throughout the year.

Organizers: The programme was co-ordinated by Professor G. Furlan (University of Trieste, Italy, and ICTP) in collaboration with Profs. G. Denardo (ICTP) and E. Tosatti (International School for Advanced Studies, SISSA, Trieste, Italy, and ICTP) as well as Advisory Committees in each of the fields concerned. The Italian Agency for New Technologies, Energy and Environment (ENEA, Rome, Italy) and the National Research Council (CNR, Italy) offered regular contributions.

Purpose: To give participants in ICTP activities the opportunity of widening their experience by becoming directly involved in different branches of physics with the research work of laboratories at Italian universities, governmental and industrial research centres.

Programme: In 1995, 95 scientists representing 28 Developing Countries worked — with grants from the ICTP — in 70 Italian Laboratories for a total of 500.40 person-months. In addition, 2 consultants visited the ICTP.

The research subjects included:

Physics of Condensed Matter: Solid State Physics and Materials Science, Computational Methods, Atomic and Molecular Physics, Laser Spectroscopy.

Physics and Energy: Plasma Physics and Fusion, Non Conventional Energy Sources, Applied Nuclear Physics.

Physics and Technology: Optical Physics and Lasers, Communication Physics and Optical Fibres, Microprocessors and Informatics, Synchrotron Radiation Applications.

Earth and Environmental Sciences: Geophysics and Seismology, Oceanography, Physics of the Atmosphere and Aeronomy, Meteorology and Climatology, Soil Physics, Environmental Control, Mathematical Ecology.

Physics of the Living State: Biophysics, Medical Physics, Neurophysics.

Miscellaneous: Instrumentation for Nuclear and Subnuclear Physics, Space Physics, Topics at the Interface with Chemistry and Engineering, etc.

Breakdown of visitors by geographical areas

Areas	Scientists	Person-months
Africa	19	96.40
Asia	37	231.15
Europe (Dev.)	25	105.01
North & Central America	3	27.30
South America	11	40.54
TOTAL	**95**	**500.40**

EXTERNAL ACTIVITIES

As of 31 December 1995, the OEA sponsored the following activities:

78 scientific meetings:

21 in Africa:	Benin, Côte d'Ivoire, Egypt, Ghana, Kenya, Morocco, Nigeria, Senegal, South Africa, Sudan, Tunisia, Zaire, Zimbabwe.
33 in Asia:	Bangladesh, China, Jordan, India, Iran, Malaysia, Hong Kong, Korea, Pakistan, Philippines, Thailand, Turkey, Vietnam.
19 in Latin America:	Argentina, Brazil, Colombia, Cuba, Mexico, Uruguay, Venezuela.
5 in other regions	Bulgaria, Italy, Romania.

6 Networks:

1. Asian African Association for Plasma Training (AAAPT) in 16 countries of Asia and Africa.
2. Argentina-ICTP Scientific Cooperation Programme (Latin American countries).
3. Bi-regional Network on Telecommunications (Argentina, Brazil, Nigeria).
4. Mathematics Project for Scientific Development (Brazil, Peru, Andean Countries).
5. Regional Network on Mathematical Physics and Theoretical Computer Science (Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam).
6. Network on Representation Theory: Chile, Argentina, Uruguay.
7. Network on Metals and Alloys (Bangladesh, India, Nepal).
8. Regional Network on Material Sciences between Colombia, Peru, Argentina.
9. African Network on Lasers, Atoms, and Molecules (LAM) in all African countries.
10. Network among Peru, Mexico, Chile on Thin Films.

10 Affiliated Centres: Benin, Brazil, China, Ethiopia, Ghana, Jordan, Mexico, Morocco, Senegal, Sudan.

3 Affiliated Centres already terminated as follow-up activities: Bangladesh, Morocco, Pakistan.

19 Visiting Scholars/Consultants to visit Institutes in the following countries: Argentina, Bangladesh, Chile, China, Cuba, Ghana, India, Indonesia, Pakistan, Senegal, Sudan, Turkey, Vietnam, Zimbabwe.

BOOKS AND EQUIPMENT DONATION PROGRAMME

In 1995 the ICTP/TWAS Donation Programme distributed 77,000 books, proceedings and journals to around 500 institutions in 90 developing countries.

In order to assure a good distribution of the material, focal points of distribution were created in the following 32 countries: Albania, Algeria, Argentina, Bangladesh, Benin, Brazil, Chile, Colombia, Cuba, Egypt, Honduras, India, Iran, Jordan, Kenya, Mexico, Morocco, Nepal, Nigeria, Pakistan, Peru, Romania, Senegal, Sudan, Syria, Tanzania, Thailand, Tunisia, Turkey, Venezuela, Zaire and Zimbabwe. The material is sent to these focal points in bulk and then redistributed to other universities in their country. In Africa, Benin and Tanzania have agreed to receive bulk shipments and to distribute the material to institutes in their own country as well as to nearby countries. All together there are now 38 focal points, as in large countries there is more than one focal point.

Books, proceedings and journals are also mailed directly from the ICTP, on a continuos basis, to all the institutions included in the Donation Programme mailing list and to those institutions which requested specific material which was available within the programme.

In 1995, donations were received by many organizations and individuals, among which we would like to mention the American Institute of Physics, the American Physiological Society, the American Physical Society, Elsevier Science Publishers, Editions Frontières, Environmental Briefs Corporation, Gothard House Group of Companies, International Council of Scientific Unions, International Union of Pure and Applied Physics, Lindsay Ross, Kluwer Academic Publishers, the Royal Society, the Royal Swedish Academy, Strasbourg Astronomical Observatory, the VIC Library, World Scientific Publishing Company.

Besides the donations directly distributed by the ICTP, a large number of complete sets of back issues of journals and books were shipped directly by the donors to institutions in several developing countries. Packing and transportation expenses were covered by the ICTP. The visiting scientists of the ICTP have also the opportunity to select personally books and proceedings from our Donation Programme, which are mailed directly to their home institutions.

The following journals are distributed regularly by the Donation Programme:

International Journal of Modern Physics A	180 institutions in 50 countries
Modern Physics Letters A	"
International Journal of Modern Physics B	150 institutions in 44 countries
Modern Physics Letters B	"
Europhysics News	100 institutions in 48 countries
American Journal of Physiology	25 institutions in 23 countries
Journal of Applied Physiology	"
Journal of Neurophysiology	"
Physiological Reviews	"
Physica Scripta	40 institutions in 37 countries
Acta Zoologica	50 institutions in 40 countries
Zoologica Scripta	"
Environmental Briefs	100 institutions in 50 countries.

The ICTP in collaboration with the American Physical Society is matching 30 memberships and journals subscriptions for scientists in 21 developing countries. Under this scheme, among other material, scientists receive the following journals: Physics Review A, B, C, D, and E.

In 1995 the ICTP covered the shipping costs of equipment which was donated to institutions in a few developing countries.

AWARDS

DIRAC MEDAL OF THE ICTP

8 August 1995

The 1995 Dirac Medal of the ICTP was awarded to Michael Berry (Royal Society Research Professor at the University of Bristol, UK) for his discovery of the non-integrable phase that arises in adiabatic processes in quantum theory. This effect was first detected in 1986 in an optics experiment by Tomita and Chiao in which the rotation of the polarization plane of a wave propagating in a twisted optical fibre was interpreted as a Berry phase. In the same year it was found that the frequency splitting in the nuclear quadrupole resonance spectra of a slowly rotating nucleus could be ascribed to a Berry phase phenomenon.

The Berry phase is now known to play a significant role in many different areas of microscopic physics ranging from chemistry and molecular physics to optics, nuclear and solid state physics and relativistic quantum field theory. In all these areas the recognition of the non-integrable phase has led to a deepening of our understanding of the underlying quantum dynamics.

The International Centre for Theoretical Physics instituted the Paul Adrien Maurice Dirac Medal in 1985. The Medal is awarded yearly on P.A.M. Dirac's birthday — 8 August — for contributions to theoretical physics and mathematics. The Medalists also receive a cheque for US$ 5,000.

A selection committee including Professors N. Cabibbo (Italy), S. Lundqvist (Sweden), Y. Nambu, S. Weinberg, E. Witten (all from USA) and Abdus Salam (ICTP) selects the winners from among nominated candidates. The Committee invites nominations from anyone working in the areas of theoretical physics or mathematics.

The Dirac Medals of the ICTP are not awarded to Nobel Prize or Wolf Foundation Prize winners.

ICTP PRIZE 1995 IN HONOUR OF STEVEN WEINBERG

14 June 1995

The 1995 ICTP Prize in the field of High Energy Physics, in honour of Professor Steven Weinberg, was awarded to Professor Spenta Wadia from the Tata Institute for Fundamental Research Bombay, India.

Professor Wadia is an eminent Indian scientist, whose research work in theoretical High Energy Physics has received international acclaim. He graduated in theoretical physics at the City University of New York in 1978. From 1978 to 1982 he was a postdoctoral fellow at the Enrico Fermi Institute in Chicago. During this period, he made important contributions in the study of gauge theories, both on the lattice and continuum. Particularly noteworthy are his results on large-N phase transition and the derivation of loop-equation in lattice gauge theories. He joined TIFR in 1982. Since then he has worked on a number of subjects in theoretical physics, including string theory and 2-dimensional quantum gravity. In particular, he and his collaborators were one of the first groups to propose that the Liouville mode in the non-critical strings provides an extra space-time dimension. His group was also one of the first to construct a black hole solution in 2-dimensional string theory, thereby opening the way to a new line of research, namely the study of black hole backgrounds in string theory. He and his collaborators also produced a series of interesting works in c=1 matrix models, revealing the underlying fermionic system and the related W_∞ symmetry. These works also led to bosonization of non-relativistic fermion systems in 1+1 dimension.

Annual ICTP Prizes were created in 1982 by the ICTP Scientific Council in recognition of outstanding and original contributions within Mathematics and Physics. Every year, a Prize in honour of an eminent scientist is announced in a specific field of interest.

MEETINGS HOSTED

Acronyms:
ICGEB – International Centre for Genetic Engineering and Biotechnology (Trieste, Italy).
TWNSO - Third World Network of Scientific Organizations (Trieste, Italy).

	Title	Dates	Organizer
1.	UNESCO's physics Action Committee meeting: "Second WG3 meeting"	20-21 Jan	UNESCO/ICTP
2.	Erasmus European Advanced School on Structural Geology and Tectonics	20 Mar - 8 Apr	Univ. of Florence (Italy)
3.	Drafting meeting of WG3 UNESCO's physics Action Committee	29 Mar - 5 Apr	UNESCO/ICTP
4.	Theoretical course on "RNA structure and Fiction"	2-5 May	ICGEB
5.	TWNSO meeting and consultation on strategies for research in biodiversity and land degradation in the South	8-10 May	TWNSO
6.	Second Workshop on the Gulf of Otranto	22-24 Jun	Prof. G. Furlan (ICTP)
7.	17th Meeting of the Adriatic Alps Regional Association Working Committee for scientific and technological cooperation	26-28 Jun	Alpe Adria
8.	Euroconference on "Coincident studies of electron and photon impact ionisation"	30 Nov - 2 Dec	Rome University
9.	Third Elettra users' meeting	4-5 Dec	Sincrotrone Trieste S.p.A.
10.	Training course on marine pollution data management	11-16 Dec	Laboratorio Biologia Marina, Trieste

PART III

PUBLICATIONS

(A) PROCEEDINGS

KEY:
WSPC — World Scientific Publishing Co., Singapore.

Proceedings published in 1995:

	Dates of Activity	Title of Activity	Publisher	Pages
1.	1988, 16–20 May and 1990, 21 May–1 Jun	Modelling of Atmospheric Flow Fields	WSPC	750
2.	1991, 19 Aug – 6 Sep	College on Singularity Theory	WSPC	982
3.	1992, 27 Apr – 19 Jun	Spring College in Condensed Matter on "Superconductivity"	WSPC	400
4.	1992, 24 Aug – 4 Sep	Lecture Notes Volume on Quantum Field Theories for Condensed Matter Physicists	WSPC	600
5.	1993, 1–17 Jan	BCSPIN – Institute of Physics – S.N. Bose National Centre for Basic Science Winter School "Particle Physics and Cosmology at the Interface"	WSPC	570
6.	1993, 25–29 Jan	Workshop on functional analytic methods in complex analysis and applications to partial differential equations	WSPC	420
7.	1993, 3–6 Aug and 26 Jul – 6 Aug	Mesoscopic Systems and Chaos: A Novel Approach	WSPC	200
8.	1993, 20 Sep – 1 Oct	Second Workshop on Composite Media and Homogenization Theory	WSPC	300
9.	1993, 25–29 Oct	Conference on chemical evolution and origin of life (Ponnamperuma Festschrift)	Deepak	337
10.	1994, 11–22 Apr	Spring School and Workshop on String Theory, Gauge Theory and Quantum Gravity	Elsevier	357
11.	1994, 11 Apr – 13 May	Workshop on Nuclear Reactors — Physics, Design and Safety	WSPC	1200
12.	1994, 13 Jun – 29 Jul	Summer School in High Energy Physics and Cosmology	WSPC	700
13.	1994, 29 Aug – 2 Sep	Conference on the structure and model of the first cell	Kluwer	383
14.	1994, 10 – 28 Oct	School and Workshop on Variational and Local Methods in the Study of Hamiltonian Systems	WSPC	250

Courses held in 1995 whose proceedings are to be published:

	Dates of activity	Title of Activity	Publisher
1.	27 Mar – 7 Apr	Spring School and Workshop on String Theory, Gauge Theory and Quantum Gravity	Elsevier
2.	10–12 Apr	Trieste Conference on Recent Developments in Statistical Mechanics and Quantum Field Theory	Elsevier
3.	8–12 May	Conference on perspectives in nuclear physics at intermediate energies	WSPC
4.	5–9 Jun	Trieste Conference on S-duality and mirror symmetry	Elsevier
5.	12 Jun – 28 Jul	Summer School in high energy physics and cosmology	WSPC
6.	17–28 Jul	Fourth school on non-accelerator particle astrophysics	WSPC
7.	18–21 Jul	Adriatico Research Conference on Chaos in Atoms and Molecules	WSPC
8.	7–11 Aug	Miniworkshop on Josephson junctions array	Elsevier
9.	4–8 Sep	Trieste Conference on chemical evolution IV: Physics of the origin and evolution of life — "Cyril Ponnamperuma Memorial"	Kluwer
10.	4–15 Sep	Workshop on general theory of partial differential equations and microlocal analysis	Longman
11.	30 Oct – 3 Nov	Ninth International Symposium of "Ultrafast Processes in Spectroscopy" (UPS '95)	Plenum
12.	5–8 Dec	Adriatico Research Conference on trends in collider spin physics	WSPC

(B) PREPRINTS AND INTERNAL REPORTS

Number of preprints and internal reports (including the LAMP Series Reports) issued in 1995: 431.

Number of preprints and internal reports produced by scientists from developing countries: 392.

Explanatory Note:

The **names** of those scientists who participated in the research activities of the ICTP in 1995 and submitted their articles for publication are indicated by country codes.

The **country codes** indicate the countries of origin, according to the following ICTP internal list:

ALB	Albania	ITA	Italy
ALG	Algeria	IVC	Côte d'Ivoire
ARG	Argentina	JOR	Jordan
ARM	Armenia	JPN	Japan
AUL	Australia	KEN	Kenya
AUS	Austria	LIB	Libya
AZB	Azerbaijan	MAG	Madagascar
BEN	Benin	MLI	Mali
BGD	Bangladesh	MOL	Moldova
BLR	Belarus	MON	Mongolia
BOH	Rep. of Bosnia and Herzegovina	MOR	Morocco
BRA	Brazil	NEP	Nepal
BUL	Bulgaria	NIR	Nigeria
CAN	Canada	PAK	Pakistan
CHA	P.R. China	PER	Peru
CHI	Chile	POL	Poland
CMR	Cameroon	ROK	Republic of Korea
COL	Colombia	ROM	Romania
CRO	Croatia	RSF	Russia
CUB	Cuba	RWA	Rwanda
CZH	Czech Rep.	SUD	Sudan
EGY	Egypt	TOG	Togo
ETH	Ethiopia	TUR	Turkey
GEO	Georgia	UKD	United Kingdom
GER	Germany	UKR	Ukraine
GHA	Ghana	USA	United States of America
GUI	Guinea	UZB	Uzbekistan
HUN	Hungary	VEN	Venezuela
IND	India	VTN	Viet Nam
IRA	Iran	ZAI	Zaire

PREPRINTS AND INTERNAL REPORTS IN PHYSICS OF CONDENSED MATTER

	AUTHOR	COUNTRY	TITLE	ICTP SERIAL NUMBER
1.	Tapas Mitra Mookerjee Abhijit	IND	A slab-mode formulation for conductivity	IC/95/7
2.	Dominguez Daniel Cerdeira Hilda A.	BRA	Spatio-temporal chaos and thermal noise in Josephson junction series arrays	IC/95/9
3.	Perez G. Cerdeira Hilda A.	BRA	Extracting messages masked by chaos	IC/95/10
4.	Dominguez Daniel Cerdeira Hilda A.	BRA	Breakdown of the law of large numbers in Josephson junction series arrays	IC/95/11
5.	Pando L. Carlos L. Cerdeira Hilda A.	BRA	Life times of chaotic attractors in multi-dimensional laser system	IC/95/13
6.	Goveas N. Mukhopadhyay G.	IND	Study of Blume-Emery-Griffiths model by Bethe-Peierls method	IC/95/14
7.	Zhong-Yi Lu Zhao-Bin Su Lu Yu	CHA	The doping induced quantum bound states within the haldane gap	IC/95/22
8.	Wang W.Z. Wang C.L. Bishop A.R. Lu Yu Su Z.B.	CHA	The dynamic Jahn-Teller effect in C_{60}: self trapped excitons and resonant Raman scattering	IC/95/23
9.	Protogenov A.	RSF	Haldane's statistical interactions and universal properties of anyon systems	IC/95/26
10.	Canessa Enrique	CHI	Structural transition models for a class of irreversible aggregates	IC/95/28
11.	Bilic A. Gumhalter B.	CRO	Quantum versus semiclassical treatment of multiphonon effects in He atom scattering from surfaces	IC/95/30
12.	Gruver J.L. Aliaga J. Cerdeira H.A. Proto A.N.	ARG ARG BRA	Infinite set of relevant operators for an exact solution of the time-dependent Jaynes-Cummings Hamiltonian	IC/95/36

	AUTHOR	COUNTRY	TITLE	ICTP SERIAL NUMBER
13.	Shaojin Qin Tiezheng Qian Yu Lu Zhao-Bin Su	CHA	Breakdown of quasiparticle picture in the low-density limit of the 1D Hubbard model	IC/95/40
14.	Mata G.J. Valera M.	VEN	Monte Carlo simulation on the surface magnetic phase transition in chromium	IC/95/42
15.	Canali C.M. Kravtsov V.E.	ITA RSF	Normalization sum rule and spontaneous breaking of U(N) invariance in random matrix ensembles	IC/95/46
16.	Dominguez D. Cerdeira H.A.	BRA	Turbulence, chaos and thermal noise in globally coupled Josephson junction arrays	IC/95/47
17.	Mata G.J. Noguera A.	VEN	The effect of disorder on the local density of electronic states at an interface	IC/95/52
18.	Tit Nacir Peressi M.	ALG	Electronic structure of GaAs with InAs(001) monolayer	IC/95/62
19.	Fonda Luciano	ITA	Multiple scattering theory of electron emission diffraction and x-ray absorption in the presence of Coulomb-like potentials	IC/95/64
20.	Tosatti E.	ITA	Surface states, surface metal-insulator and surface insulator-metal transitions	IC/95/69
21.	Nafari N. Payami M.	IRA	Nonlocal stabilized jellium clusters	IC/95/78
22.	Gruver J.L. Aliaga J. Cerdeira H.A. Proto A.N.	ARG ARG BRA	Quantum dissipation in a dynamical collective effect	IC/95/81
23.	Gaitan Frank Shenoy R. Subodh	USA IND	Berry's phase, Josephson's equation and the dynamics of weak link superconductors and their vortices	IC/95/89
24.	Pesheva N.C. Brankov J.G. Canessa E.	CHI	Layer features of the lattice gas model for self-organized criticality	IC/95/95
25.	Hontinfinde F. Touzani M.	MOR	Kinetic growth of a two-dimensional crystal	IC/95/103
26.	Islam A.K.M.A.	BGD	Lithium hydride near melting point	IC/95/119

	AUTHOR	COUNTRY	TITLE	ICTP SERIAL NUMBER
27.	Sanyal Sankar P.	IND	Schottky defect formation energy of alkali hybrides	IC/95/121
28.	Adam Gh. Adam S.	ROM ROM	A symmetry based study of positron annihilation spectra	IC/95/123
29.	Biswas P. Sanyal B. Fakhruddin M. Halder A. Mookerjee Abhijit Ahmed Mesbahuddin	 IND BGD	An augmented-space recursion in the k-space representation	IC/95/124
30.	Kalpana G. Palanivel B. Thomas Reena Mary Rajagopalan M.	 IND	Electronic and structural properties of MgS and MgSe	IC/95/137
31.	Elzain M.E. Yousif A.A.	SUD	The magnetism of 3d impurities in alkali metals	IC/95/141
32.	Tankeshwar K.	IND	Mass dependence of self-diffusion in isotopic fluids	IC/95/143
33.	Gumhalter Branko	CRO	Different aspects of the Debye-Waller factor in various atom-surface scattering theories	IC/95/144
34.	Pisanova E.S. Tonchev N.S.	BUL	Modified finite-size scaling for anharmonic crystal with quantum fluctuations	IC/95/153
35.	He-Ping Ying	CHA	A loop-flip algorithm for the anisotropic quantum Heisenberg antiferromagnet	IC/95/154
36.	Shaojin Qin Shoudan Liang Zhaobin Su Yu Lu	 CHA	Density matrix renormalization group calculation of correlation functions in one-dimensional Hubbard model	IC/95/156
37.	Plakida N.M. Horsch P. Liechtenstein A. Oudovenko V.S.	RSF	Superconducting pairing of spin polarons in the t-J model	IC/95/157
38.	Despa Florin Apostol Marian	ROM	On the geometrical factor in the off-centre diffusion	IC/95/161
39.	Florin Despa Apostol M.	ROM	Kinetic aspects of the embedded clusters: reaction-rate theory	IC/95/169

	AUTHOR	COUNTRY	TITLE	ICTP SERIAL NUMBER
40.	Saha Tanusri Mookerjee Abhijit	IND IND	Effect of local lattice distortion in nonisochoric alloys: CuPd and CuBe	IC/95/170
41.	Pushkarov D.I.	BUL	Mechanics and transport of quasiparticles in deformed lattice structures	IC/95/173
42.	Mejdani R. Lambros A.	ALB	A ladder Ising spin configuration. Heat capacity	IC/95/178
43.	Vicente Alvarez J.J. Ceccatto H.A. Balseiro C.A.	ARG	Mixed boson-fermion description of correlated electrons: fluctuation corrections *in the symmetric treatment*	IC/95/179
44.	Feiguin A.E. Gazza C.J. Trumper A.E. Ceccatto H.A.	ARG	Spin stiffness of frustrated Heisenberg antiferromagnets: finite size scaling	IC/95/180
45.	Derzhko Oleg Krokhmalskii Taras Verkholyak Taras	UKR	Thermodynamical properties of random spin-1/2 XY chain with Dzyaloshnskii -Moriya interaction	IC/95/181
46.	Derzhko Oleg Verkholyak Taras	UKR	1D spin-1/2 XY models as a testing ground for spin system theory methods	IC/95/182
47.	Mejdani R. Borici A. Kasa A. Gjonaj E.	ALB	The variation of the mean "size" of *polyatomic boxes versus the temperature*: A Monte Carlo simulation (a one-dimensional lattice binary mixture)	IC/95/183
48.	Dzhumanov S. Baratov A.A. Abboudy S.	UZB EGY	The pairing theory of polarons in real- and impulse spaces	IC/95/186
49.	Senouci K. Zekri N. Ouasti R.	ALG ALG	Conductance fluctuations and distribution in disordered chains in presence of an electric field	IC/95/194
50.	Dasgupta Indra Mookerjee Abhijit	IND	An augmented space recursive method for the first principles study of concentration profiles at CuNi alloy surfaces	IC/95/195
51.	Dikandé Alain M. Kofané T.C.	CMR	Misfits and dislocations on two-dimensional monolayer surfaces	IC/95/197
52.	Dikandé Alain M. Kofané T.C.	CMR	Soliton scattering by impurities in a short-length sine-Gordon chain	IC/95/198

	AUTHOR	COUNTRY	TITLE	ICTP SERIAL NUMBER
53.	Dikandé Alain M.	CMR	On an eigenvalue problem bearing nonlinear dynamical systems	IC/95/199
54.	Dikandé Alain M.	CMR	Microscopic domain walls in quantum ferroelectrics	IC/95/200
55.	Hong Quang Nguyen	VTN	Density-dependent squeezing of excitons in highly excited semiconductors	IC/95/204
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133.	Thompson George	AUL	New results in topological field theory and Abelian gauge theory	IC/95/339
134.	Blau Matthias Thompson George Hussain Faheem	 AUL PAK	Some aspects of coset models and topological Kazama-Suzuki models	IC/95/340
135.	Blau Matthias Hussain Faheem Thompson George	 PAK AUL	Grassmannian topological Kazama-Suzuki models and cohomology	IC/95/341
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2.	Zhang Y.Z. Mahajan S.M.	CHA IND	Comment on radial structure of high-mode-number toroidal modes in general equilibrium profiles	IC/95/20
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10.	Dumitrescu Ovidiu Bulboaca Iosif Carstoiu Florin Sandalescu Aurel	ROM	Double fine structure in the cluster radio-activity of ^{252}Cf	IC/95/175
11.	Berezhiani V.I. Mahajan S.M.	GEO IND	Beat-wave generation of plasmons in semiconductor plasmas	IC/95/207
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13.	Kartal S. Tsintsadze L.N. Berezhiani V.I.	TUR GEO GEO	Localized structures of electromagnetic waves in hot electron-positron plasma	IC/95/253
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4.	Molchan G.M. Kronrod T.L. Dmitrieva E.O.	RSF RSF RSF	Statistical analysis of seismicity and hazard estimation for Italy (mixed approach): Statistical parameters of main shocks and after-shocks in the Italian region	IC/95/27
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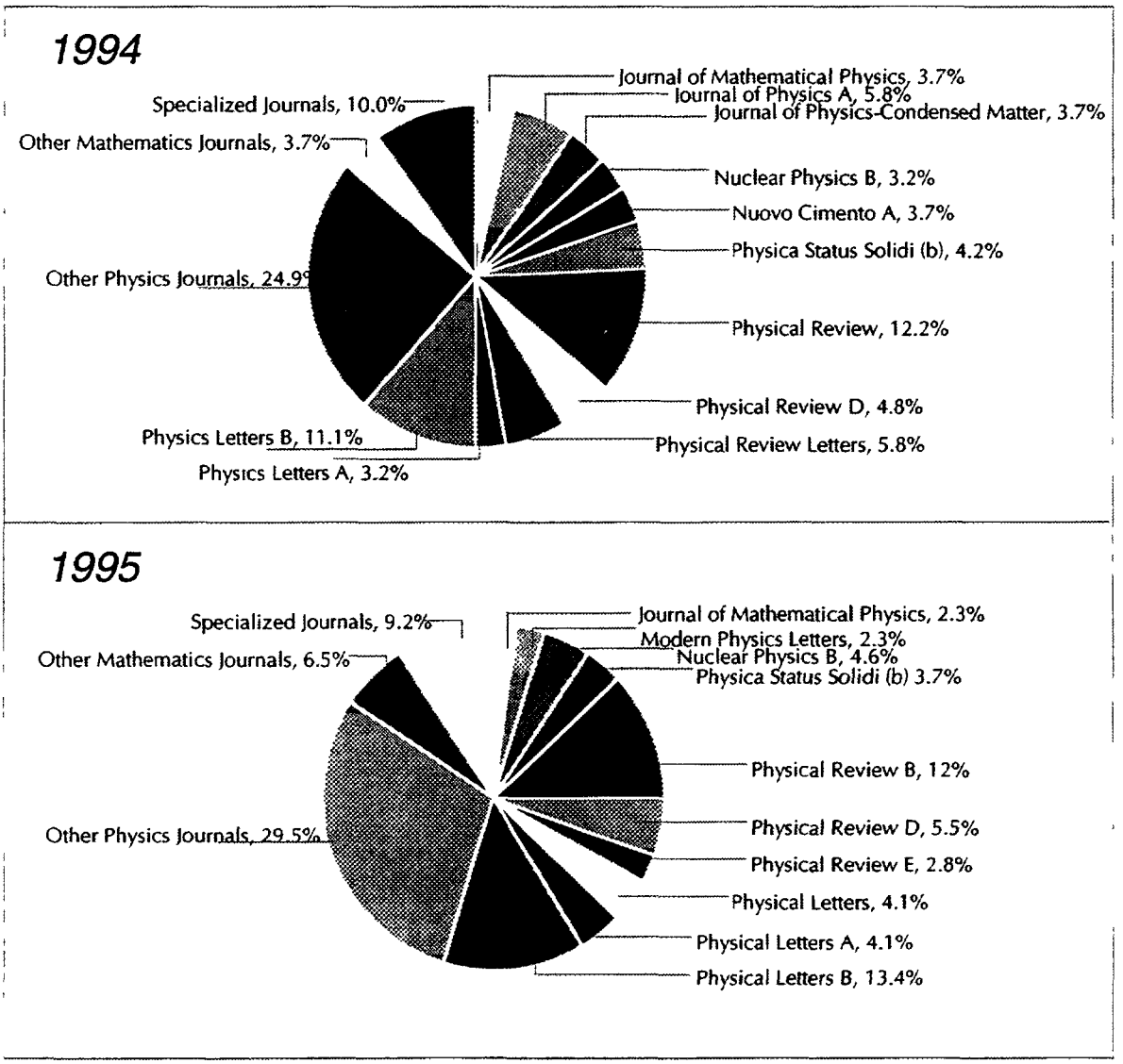
ICTP PREPRINTS
PUBLISHED IN 1994 AND 1995

The following chart shows a breakdown of the most popular journals in which ICTP preprints were published in 1994 and 1995.

Source: *1994-1995 Science Citation Index.*



THE LIBRARY

The Library covers all of the topics included in the ICTP's research and training programme, as well as many other areas of interest. It is considered to be amongst the best in the area of physics, mathematics and related sciences.

Experience has shown that over the past 30 years one of the largest benefits for visitors is the possibility of using a very well equipped up-to-date Library, in terms of scientific periodicals, books and pre-prints. It should be pointed out that several scientists consider the ICTP Library as one of the main reasons for coming to Trieste.

Presently the Library subscribes to about 900 scientific periodicals, and has on its shelves about 52,000 books. Book acquisitions number about 2,000 a year. Mention should also be made to the ever increasing CD-ROM collection which at the moment consists of about 50 optical disks.

Moreover, the Library's automated bibliographical records are accessible on-line from any computer connected to Internet world-wide. This may be done so in three ways: Telnet directly, ICTP Gopher and WWW. Steps are now being taken, and will continue into 1996, for complete retroconversion and bar-coding of material. This will not only permit on-line searching of the collection, but it is hoped that it will be followed by the automation of Loans in the near future.

Books	52,000
Bound journals	47,000
Subscriptions to journals	900
Theses	1,500
Preprints/Reports	50,000
Micro–fiche (journals)	30
CD-ROMs	50
Loans per year	20,000
Interlibrary loans	300
Registered users per year	5,000
Acquisitions (books) per year	2,000