Nonlinear interaction of magnetized electrons with EC waves: Anomalous particle transport and self-consistent wave evolution

C. Tsironis and L. Vlahos

Section of Astrophysics, Astronomy and Mechanics, Department of Physics, University of Thessaloniki, 54124 Thessaloniki, Greece

The nonlinear interaction of relativistic electrons with electron-cyclotron waves in a constant magnetic field is studied. The interaction is analyzed over and near the local threshold to stochasticity. We analyze the electron diffusion across the magnetic field in real and energy space for various values of the wave amplitude and angle of propagation. The diffusion is found to obey simple power law in time and the scaling exponents correspond to sub-diffusion. This is connected to the effect of the resonant phase-space islands in the particle motion. The statistical character of the forces that control the trajectories of the particles is also studied. The forcing term is highly inhomogeneous along the particle orbit and contains non-Gaussian characteristics. This reflects to the properties of the particle motion. For example, the orbit of the gyro-center under the drift force **E**x**B** consists of smooth jumps between locations where the particle remains trapped. Finally, a self-consistent model for the wave-particle interaction is considered. In this model, the current density coming from the electron orbits is taken into account in the description of the temporal evolution of the wave amplitude and frequency. In this manner, wave generation and absorption in the plasma can be studied consistently with the dynamical behaviour of the beam and plasma particles.