

Self-field in free-electron laser with planar wiggler and ion-channel guiding

B.Farrokhi, and F.Jafary

Department of Physics, Bu-Ali Sina University, Hamadan, Iran

E-Mail: bfarrokhi@basu.ac.ir

Institute for studies in theoretical physics and mathematics

P. O. Box 19395-5531, Tehran, Iran

E-Mail: farrokhi@theory.ipm.ac.ir

A self-consistent method for the analysis of self electric and self magnetic field for a free-electron laser with a one-dimensional planar wiggler and ion-channel guiding is presented. The equilibrium orbits and their stability, under the influence of self-electric and self-magnetic fields are analyzed. New unstable orbits, in the first part of the group I orbits and in the resonance region of the group II orbits, are found. It is shown that an increase in the defocusing effect of self-field will widen the unstable orbits. An anomalous self-field regime is found where an increase in the defocusing effect of self-field can have stabilizing effect on the resonance region. The application of an ion-channel as an electron beam-guiding medium not only eliminates the use of solenoid or quadrupole magnets, but also allows for beam currents higher than the vacuum limit.

1- C.Chen and R .C. Davidson, Phys.Rev.A43, 5541(1991)

2- H.Mehdian, M.Esmelzadeh, and J.E.Willet, Phys. Plasmas 9,670(2002)