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Electromagnetic simulation of multiple electrons beams propagation in a background plasma.

F. J. Simões Junior and M. V. Alves

National Institute of Space Research - INPE (Av. dos Astronautas 1758, 12227-010, Fax +5512 39456710, S. J. dos Campos, SP, Brazil)

It is by now well known that electron beams play an important role in generating solar radio emissions such as type II and III solar radio bursts. When a solar flare occurs, electron beams are injected from the Sun into the interplanetary medium. These electron beams propagate along the interplanetary magnetic field line with velocities parallel to the magnetic field that are much larger than the electron thermal speed in the solar wind. Recent researches suggest that multiple electron beams could be injected over a period of time and that as they propagate from the Sun, they tend to lose their individual identity to form just a single beam (Li et al., Phys. of Plasmas, 9, 2976, 2002). In this work we use an electromagnetic PIC code (KEMPO 1D, modified) to simulate two beams with are injected into a plasma at different times. The first beam disturbs the background plasma and generates Langmuir waves by electron beam-plasma interaction. Subsequently, another beam is inserted in the system and interacts with the first one and with the Langmuir waves to produce electromagnetic radiation. The initial conditions for the background plasma and the electron beams are based on the solar wind observations. In our model we consider that the first beam and second beam (for simple and multiples injections) are, at t=0, fully injected into the system, i.e., the beam occupies all the system; this is necessary to avoid grid effects at the boundaries and gives the possibility of using a more simple model. The preliminary results of our simulation show that the first beam can produce harmonics of plasma frequency, but the second beam intensifies the emission at the harmonics that are produced for the first one. The second beam interacts very fast with the Langmuir waves due to the strong electric field and the phase coupling with the first beam. An increasing of magnetic and kinetic energies is also observed.