
Electromagnetic radiation emitted at fundamental and harmonic plasma frequencies by weak electron beams in inhomogeneous solar wind plasmas : 2D PIC simulations

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Résumé

Two-dimensional Particle-In-Cell simulations are performed to study the electromagnetic radiation emitted at fundamental and harmonic plasma frequencies by a weak electron beam propagating in a background plasma with random density fluctuations, in solar wind conditions relevant to Type III solar radio bursts. The simulations use a panel of physical and numerical parameters that were not reached in previous works and involve self-consistently varying random plasma density fluctuations in an exceptionally large and well resolved simulation box. The dynamics of the waves, the beam and the inhomogeneous plasma are calculated over several thousands of plasma periods. For relevant comparisons, simulations with and without applied density fluctuations are performed for the same parameters. For the first time, the essential impact of density fluctuations of average levels of a few percent of the background plasma on the physical mechanisms driving the generation of electromagnetic waves is shown. Not only wave nonlinear interactions contribute to the generation of such emissions, but also processes of Langmuir waves' transformations on the density fluctuations.

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