Electron beams and Langmuir turbulence in high-latitude ionosphere

Strong Langmuir turbulence and Langmuir collapse produced by beam-plasma interactions have beam observed over wide range of plasma parameters (over 23 orders of magnitude of plasma density and 4 orders of electron temperature) and huge ranges of wave and particle energy densities. They have been naturally produced in interplanetary medium by so called type-III electron beams and also in Earth's foreshock by foreshock electron beams. Recently coherent echoes observed in incoherent scatter radar data in high-latitude ionosphere have proposed occurrence of Langmuir turbulence and wave collapse in limited heights close to ionospheric F-region peak [*Akbari et al.*, 2013]. On the other hand large amplitude Langmuir waves associated with electron beams with dispersive signature have been observed in the auroral ionosphere by rockets and satellites for many years [*Ergun et al.*, 1991]. Given the strong interaction of beams and plasma much can happen between the altitudes of the in-situ observations and altitude of radar observations. It is know that in the absence of a saturating mechanism for Langmuir waves bump-on-tail instability and the resulting quasi-linear diffusion removes the energy in short time scales and as the result the beam would not be able to generate turbulence at lower altitudes. In this work 1D Zakharov simulation is employed to investigate the beam parameters, i.e. beam density, beam energy, and beam's velocity spread, that are required to produce Langmuir turbulence at the F-region heights. Results of the simulation is compared with in-situ measurements of electron beams, electrostatic waves and electromagnetic emissions at higher altitudes in ionosphere and the evolution of the beam and nature of the saturating mechanism is investigated as it propagates to lower altitudes.

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