Geophysical Research Abstracts
Vol. 17, EGU2015-8657-1, 2015
EGU General Assembly 2015

The effect of plasma inhomogeneities on (i) radio emission generation by non-gyrotropic electron beams and (ii) particle acceleration by Langmuir waves

David Tsiklauri
Queen Mary University of London, School of Physics and Astronomy, London, United Kingdom (d.tsiklauri@qmul.ac.uk)

Extensive particle-in-cell simulations of fast electron beams injected in a background magnetised plasma with a decreasing density profile were carried out. These simulations were intended to further shed light on a newly proposed mechanism for the generation of electromagnetic waves in type III solar radio bursts [1]. Here recent progress in an alternative to the plasma emission model using Particle-In-Cell, self-consistent electromagnetic wave emission simulations of solar type III radio bursts will be presented. In particular, (i) Fourier space drift (refraction) of non-gyrotropic electron beam-generated wave packets, caused by the density gradient [1,2], (ii) parameter space investigation of numerical runs [3], (iii) concurrent generation of whistler waves [4] and a separate problem of (iv) electron acceleration by Langmuir waves in a background magnetised plasma with an increasing density profile [5] will be discussed. In all considered cases the density inhomogeneity-induced wave refraction plays a crucial role. In the case of non-gyrotropic electron beam, the wave refraction transforms the generated wave packets from standing into freely escaping EM radiation. In the case of electron acceleration by Langmuir waves, a positive density gradient in the direction of wave propagation causes a decrease in the wavenumber, and hence a higher phase velocity $v_{ph} = \omega/k$. The k-shifted wave is then subject to absorption by a faster electron by wave-particle interaction. The overall effect is an increased number of high energy electrons in the energy spectrum.

[1] D. Tsiklauri, Phys. Plasmas 18, 052903 (2011); http://dx.doi.org/10.1063/1.3590928

[2] H. Schmitz, D. Tsiklauri, Phys. Plasmas 20, 062903 (2013); http://dx.doi.org/10.1063/1.4812453

[3] R. Pechhacker, D. Tsiklauri, Phys. Plasmas 19, 112903 (2012); http://dx.doi.org/10.1063/1.4768429

[4] M. Skender, D. Tsiklauri, Phys. Plasmas 21, 042904 (2014); http://dx.doi.org/10.1063/1.4871723

[5] R. Pechhacker, D. Tsiklauri, Phys. Plasmas 21, 012903 (2014); http://dx.doi.org/10.1063/1.4863494

This research is funded by the Leverhulme Trust Research Project Grant RPG–311