# Beam generated Langmuir turbulence in plasmas with density fluctuations

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In the source regions of the Type III solar bursts, energetic electron beams are accelerated in the low solar corona during flares. Observations show that such beams can propagate in the solar wind up to distances around 1 AU and beyond, generating Langmuir turbulence that emits specific electromagnetic radiation. The solar wind has been revealed to be a inhomogeneous plasma with an average level of random density fluctuations reaching several percents of the background density. This circumstance allows explaining many observations performed by spacecraft which could not be predicted by the existing turbulence theories and remained unsolved during decades. Numerical simulations based on a new modelling and a novel approach show that the plasma density inhomogeneities crucially influence on the characteristics of the Langmuir wave turbulence and the beams' dynamics. Indeed, they allowed studying in details several physical processes: waves' growth and saturation, beam relaxation, slowing down and reabsorption, wave-wave coupling and wave decay cascades, particle diffusion processes, electron acceleration, transformation of waves on density fluctuations (scattering, refraction, reflection, tunnelling), modulations of waveforms, statistics of Langmuir field emission, mechanisms of electromagnetic emissions, etc…[1]-[5] Simulation results were successfully compared with recent observations by the *Stereo* and *Wind* spacecraft, and will be used to interpret forthcoming data from the *Parker Solar Probe* and the *Solar Orbiter* international missions.

[1] Krafft C., Volokitin A., Krasnoselskikh V., Astrophys. J., 778, 111, 2013.

[2] Krafft C., Volokitin A., Krasnoselskikh V., Astrophys. J., 809, 176, 2015.

[3] Volokitin A., Krafft C., Astrophys. J., 833, 166, 2016.

[4] Krafft C., Volokitin A., Astrophys. J., 821, 99, 2016.

[5] Volokitin A., Krafft C., Astrophys. J., 868, 104, 2018.