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# Numerical model with continuous injection of an electron beam into a plasma for simulation of electromagnetic emission processes

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The beam-plasma interaction plays an important role in solar radio emission. Understanding these mechanisms makes it possible to conclude about the local parameters of the solar plasma and the dynamics of various processes. A powerful, but resource-intensive tool for studying such systems is numerical particle-in-cell simulations. Usually, the infinite plasma approximation is used to describe this system. Its main drawback is the finite margin of the beam nonequilibrium. The beam pumps the wave only until the depth of its potential well in the accompanying reference frame is sufficient to trap beam electrons. After this, the evolution of all waves proceeds in the absence of any energy inflow.

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In contrast, in the model with a continuously injected from a local source electron beam, the excited plasma oscillations accumulate at a certain distance from the injection site and form a spatially localized wave packet. The oscillations in this packet are pumped continuously by "fresh"electrons, and their amplitude is saturated at a much higher level than in the temporal problem. Such a model is more resource-intensive, but with the growth of computational power in recent years this has ceased to be a significant problem. In particular, with the help of this model we proposed an interpretation of experiments on radiation generation in plasma with a thin electron beam[1], and also investigated the possibility of a significant increase of the emission level due to a three-wave process in a system with counterstreaming beams[2].

1.Annenkov,V. et al.Phys.Plasmas 26,063104(2019).
2.Annenkov,V. et al.Astrophys.J. 904,88(2020).

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