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Electromagnetic electron hole generation : theory and PIC simulations

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Recent MMS observations exploring various regions of the magnetosphere have found solitary potential structures called Electron phase-space Hole (EH). These structures have kinetic scale (dozens of Debye lengths) and persist during long time (dozens of plasma frequency periods). EH are characterized by a bipolar electric field parallel to ambient magnetic field and fastly propagate along this latter (a few tenths of speed light).

We have created a 3D Bernstein-Greene-Kruskal (BGK) model adapted to various magnetospheric ambient magnetic fields. BGK model results depend on choice of potential shape and passing distribution function at infinity (before EH potential interaction).

2D-3V Particle-In-Cell simulations have been developed with the fully kinetic code Smilei using real magnetosphere plasma parameters. Solitary waves in the magnetotail are three-dimensional potentials which can be generated through nonlinear evolution of an electron beam instability. We have also investigated the EH formation with density inhomogeneities using a BGK stability model we have developed. Indeed, density inhomogeneities exist notably in interplanetary plasmas.

Field

Solar & Stellar Physics

Day constraints

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