3rd Asia-Pacific Conference on Plasma Physics, 4-8,11.2019, Hefei, China

Electrostatic solitary structures in an electron beam-plasmas using 1-D particle in cell simulation

A. Abid[1], A. A. Abid[1], Quanming Lu[1], M. N. S. Qureshi[2], X. L. Gao[1], Huayue Chen[1], K. H. Shah[3] and Shui Wang[1]

[1]CAS Key Laboratory of Geospace Environment, Department of Geophysics and Planetary Science, University of Science and Technology of China, Hefei 23006, China, [2]Department of Physics, GC University, Lahore 54000, Pakistan

3Department of Physics, Forman Christian College (A Charted University), Lahore 54600, Pakistan

e-mail: abidaliabid1@hotmail.com

Electrostatic solitary (ES) structures have been frequently observed in the solar wind, Earth's and other planetary magnetosphere and are the most widely theoretically studied waves in literature. However, there are very few studies in which simulations and theoretical studies have been performed simultaneously. In this paper, we perform 1-D electrostatic Particle-in-Cell (PIC) simulations of electrostatic solitary (ES) waves in a plasma which consists of immobile ions, and cold, beam and hot electrons. It is found that for a small value of electron beam velocity, ES structures are formed due to the steepening of initially quasi monochromatic electron acoustic (EA) waves. We interpret these ES structures as electron acoustic solitary (EAS) structures, which agree with the rarefactive (negative electrostatic potential) electron acoustic solitary structures obtained theoretically as a solution of the Korteweg de-Vries (KdV) equation. We found that polarity of solitary structures depends on the drift velocity of electron beam and formation of electric field spikes are consistent with the ES waves observations from Earth's magnetosphere.