Generation mechanism of electron acoustic solitary structures in the Earth's magnetotail region

A. P. Kakad (1), S. V. Singh (1), R. V. Reddy (1), S. G. Tagare (2) and G. S. Lakhina (1)

(1) Indian Institute of Geomagnetism, Kalamboli Highway, New Panvel (W), Navi Mumbai - 410 218, India, (2) Shadan Institute of P.G. Studies, Khairatabad Hyderabad - 500004, India. (Contact Email: amar@iigs.iigm.res.in / 91-22-27480762)

Satellite observations have revealed solitary potential structures in the Earth's magnetotail region. These structures have both positive and negative electrostatic potentials. The electron-acoustic solitary waves in an unmagnetized electron-beam plasma system consisting of cold plasma electrons, cold beam electrons and isothermal ions with two different temperatures are studied. Using the reductive perturbation method, the nonlinear evolution of such structures is obtained. Theory is extended to study arbitrary amplitude electron-acoustic solitary waves using the Sagdeev pseudo-potential analysis. It is found that, this model supports the existence of both positive and negative electrostatic potentials. The parameter regime for both types of electron-acoustic solitary structures is obtained. The amplitude, velocity and width associated with these positive and negative solitary structures are numerically obtained. These estimates are in good agreement with the observed solitary wave structures in the Earth magnetotail region.