

COMPARISON OF ELECTROSTATIC SOLITARY STRUCTURES OBSERVED IN SPACE AND IN LABORATORY EXPERIMENTS

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Nonlinear Electrostatic Solitary Waves, or ESWs, are isolated pulses and impulsive wave packets observed in high time resolution waveform measurements obtained in space and laboratory plasmas. They usually represent the presence of structures in the form of electron and ion phase space holes and density depletions and enhancements passing by the wave detectors making the measurements. We present Cluster and Polar observations of ESWs, focusing on electron-associated ESWs that were detected near the magnetopause, in the magnetotail, and in the auroral region of earth. We compare the characteristic parameters of ESWs observed in these regions, including their time scales, velocities and sizes and relate these quantities to the electron plasma period, electron thermal velocity and Debye length. In order to better understand these space observations, we compare examples of ESWs generated by means of a suprathermal electron beam injected into a laboratory plasma at the UCLA large plasma device (LAPD) to those observed in space. Even though the plasma parameters in the laboratory and space are vastly different, we find that the time scales of the ESWs are quite comparable relative to the time associated with one period of their local plasma frequency. In addition, similar to the laboratory ESWs, the space ESWs are propagating at a few times faster than the electron thermal velocity and are several times larger than the electron Debye length.