Abstract

Proton energization is one of the active research areas in space plasma, specifically in solar wind plasma. Many researchers have reported proton energization in space plasma by utilizing various satellite observation data such as WIND spacecraft, Cluster, Parker Solar Probe (PSP) Magnetospheric Multiscale mission (MMS), and Solar Orbiter (SO), etc. Several mechanisms have been proposed to explain proton energization. One of the prime candidates responsible for proton energization in the solar wind is the double layer (DL) structures. Motivated by such a pronominal work, in this thesis, we study ion-acoustic DLs (IADLs) and their associated electric field in the solar wind region with the help of an analytical model. In this model IADLs in multicomponent unmagnetized homogenous plasma in the solar wind, containing cold inertial ions, core, halo, and strahl electrons, are examined in detail. The core thermal electrons are treated as Maxwellian, while the other two categories of electrons are modeled by Non-Maxwelliankappa distribution. To develop a nonlinear equation, we used the pseudopotential method. Additionally, the behavior and structure of DLs have been studied using a variety of plots by altering various plasma parameters, and it has been found that the profile of IADLs has altered dramatically. With support from satellite mission measurements, the electric field associated with DLs and its role in solar wind proton energization has been addressed.