SHOCK MEASUREMENTS BY DOUBLE STAR AND CLUSTER: KINETIC EFFECTS,

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ABSTRACT

One of the most important questions about collisionless shock is the structure of the electric potential across the shock. Smulation models have predicted the existence of such potentials. However, there are only a few observations that addressed this question. We have used Cluster situated in the upstream region and Double Star at the sock nose to investigate this problem. We have determined from particle observations on Double Star of a nearly perpendicular shock that H+ and He++ each losing equal amounts of energy per charge as the solar wind traverses the shock. This is a clear and unambiguous signature of deceleration caused by a charge separation electric field. This shock was accompanied by solar wind-like electron distributions throughout the shock ramp, but with significant heating. This distribution is different from the “flattop” electron distributions commonly reported. However, it is consistent with simulation models that predict flat-top distributions only appear when the angle between the magnetic field and the shock normal is less than about 60 degrees. Heating and flow energy gained by electrons can account for only ~20\\% expected from the electric potential deduced from ion observations, suggesting that electrons take a path different from the ions across the shock potential and lose energy to the solar wind electric field. This talk will include a discussion of transmitted and reflected populations including test particle simulation results.