

Three Dimensional Magnetohydrodynamic Simulations on the Interaction of Interplanetary Density Pulses with the Bow Shock

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Three dimensional magnetohydrodynamic (MHD) simulations are carried out in order to study the interaction between the density pulse in the interplanetary medium and the planetary bow shock. As the incident pulse, three distinguished types have been simulated: Pure density pulse with no variations in all other variables, density pulse with magnetic field variation in fast/slow mode type, and pure density pulse with much stronger peak. For the pure density pulse case where the peak density is 2 times the background value, its interaction with the bow shock results in various MHD waves and a shock in the magnetosheath including fast mode wave which evolves into a fast shock, entropy wave, and slow mode wave. When the similar density pulse with a magnetic field variation in fast/slow mode type is incident, the transmitted density pulse amplitude is overall reduced compared to the pure density pulse incidence. This is more pronounced for the incidence of the fast mode type pulse. Lastly, for the much stronger pure density pulse with its peak being 5 times the background value, the magnetosheath undergoes, in sequence, its first compression, an expansion due to the repulsion, and then a second compression again. This still results in similar MHD waves and a shock in the magnetosheath, but they are generated in distinguished manners.