



Solar wind deceleration in the foreshock of the Earth observed by Cluster

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Although the solar wind deceleration in the terrestrial foreshock was noticed three decades ago, previous studies show some conflicting results. This paper presents direct evidence of solar wind deceleration in the foreshock of the Earth by using the data of two Cluster satellites. On February 02, 2003, the two satellites (C1 and C3) of Cluster missions are respectively inside and outside the foreshock, approximately along the solar wind flow line, which can effectively exclude the uncertainty caused by the spatial and temporal changes of solar wind itself. Comparison of the plasma data recorded by two satellites shows that the solar wind velocity decreases in the foreshock and the largest deceleration reaches 22 km/s. The velocity distribution of ions in the phase space indicates that the solar wind ions undergo pitch angle scattering in the foreshock. The solar wind deceleration is associated with diffuse ions and ULF wave activities. The diffuse ion density reached 0.25 cm^{-3} , about 7% of the solar wind density. The interaction of ULF waves with solar wind also deflects the solar wind away from the bow shock both in the ecliptic and meridian planes. Meanwhile the solar wind deceleration is accompanied by thermalization during which the solar wind temperature can reach 240 eV.