



Enhanced diffusive ion scattering in front of the Earth's quasi-parallel bow shock: a case study

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In our study we report on observations of energetic ions upstream of the Earth's quasi-parallel bow shock by Cluster at times of large inter-spacecraft separation distance. For the analysis we use the ion data provided by the CIS-HIA in the 10-32 keV energy range and the magnetic data recorded by the FGM instrument. We determine the spatial gradient of partial energetic ion densities at various distances from the bow shock. The gradient in all energy channels decreases exponentially with distance and the e-folding distance of the gradients depends approximately linearly on energy but there is a significant difference in their values obtained at the observed three upstream ion events. We demonstrate for the first time that under specific interplanetary conditions the mechanism of the diffuse ion scattering can change significantly and results in an anomalous diffusive process characterized by an unusually small e-folding distance.