

Fast-Fermi acceleration at the Martian bow shock

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Upstream of the bow shock of Mars, MAVEN spacecraft observations show electron flux spikes with energy up to ~ 1.5 keV. These spikes are associated with sunward propagating electrons and appear when the interplanetary field lines threading the spacecraft is connected near the Martian bow shock tangency point. The loss cone distribution is a salient feature of these backstreaming electrons. Very similar distributions are seen at the terrestrial bow shock. We present a detailed analysis of the measurements and we show that the observations are consistent with a coherent encounter of the solar wind electrons with the shock. Particularly, the features observed in the distributions are used to probe the Mars cross shock potential. For the first time in the case of another planet than the Earth, these observations are explained in terms of fast-Fermi process taking place at the Martian bow shock. These accelerated electrons can then ionize neutrals to produce pickup ions in the far exosphere.