Foreshock Electrons Impacts on Hydrogen Exosphere at Mars

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Foreshock backstreaming electrons emanating from the bow shock of Mars reported from the Mars Atmosphere and Volatile EvolutioN/Solar Wind Electron Analyzer observations show a flux fall off with the distance from the shock. This feature is not observed at the terrestrial foreshock. The flux decay is observed only for electron energy E >~30 eV. A recent study indicates that Mars foreshock electrons are produced at the shock in a mirror reflection of a portion of the solar wind electrons. In this context and given that the electrons are sufficiently energetic to not be affected by the IMF fluctuations, the observed flux decrease appears problematic. We have investigated the possibility that the flux fall off with distance results from the impact of backstreaming electrons with Mars exospheric neutral hydrogen. We have demonstrated that this flux attenuation is consistent with the electron-atomic hydrogen impact cross-section for a large range of energy. A better agreement is obtained for energy where the impact cross section is the highest. One important consequence is that foreshock electrons can play an important role in the production of pickup ions at Mars far exosphere.