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ASPERA-3/MEX observations at Mars and their interpretation by a hybrid model

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Mars does not have a strong global intrinsic magnetic field and therefore the solar wind can overlap regions near the planet where the exospheric neutral density is rather high. Due to the direct interaction between the atmosphere/exosphere and the solar wind, the ionized atmospheric constituents can be picked up and accelerated by the solar wind electric field. As another manifestation, charge exchange between solar wind protons and planetary neutrals produces energetic neutral hydrogen atoms. Picked up planetary ions can also form energetic neutral atoms via charge exchange. Photoelectrons in turn can escape from Mars along open magnetic field lines.

In this presentation our focus is how a global numerical model, a Quasi-Neutral Hybrid model (QNH), can assist the interpretation of ASPERA-3 particle measurements. The QNH model is a self-consistent approach where ions are particles and electrons form a massless charge neutralizing fluid. The ASPERA-3 experiment on board Mars Express spacecraft contains separate detectors to measure ions, electrons and energetic neutral atoms. It has been measuring the Martian plasma environment since early 2004.