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Ion escape at Mars: IMA/ASPERA-3 observations and QNH model simulations

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Mars does not have a strong global intrinsic magnetic field and therefore the solar wind can flow close to the planets in high neutral density regions. Because of the formed direct interaction between the atmosphere/exosphere and the solar wind, the ionized atmospheric contents can be picked up and accelerated by the solar wind. Charge exchange between solar wind protons and planetary neutrals, instead, produce energetic neutral hydrogen atoms which are the manifestation of the direct interaction between the solar wind and planetary neutrals. Picked-up planetary ions in turn form energetic neutral atoms via charge exchange process. The ion and energized neutral escape forms the total loss flow from the planet.

In this work we are concentrating on the ion losses which are measured by ion mass analyzer IMA (ASPERA-3 experiment) onboard of Mars Express. This sensor provides 3-D measurements of both solar wind and planetary ions from the beginning of 2004. We continue the preliminary comparison [Kallio et al., Icarus, 2006] between the self-consistent 3-D quasi-neutral hybrid (QNH) model (electrons a fluid, ions are particles) and IMA observations. We focus to study: (1) similarities/differences between the properties of escaping planetary O+, O2+ and C02+ ions, and (2) the 3-D velocity distribution function of the escaping planetary ions in the tail.