Geophysical Research Abstracts, Vol. 9, 02809, 2007
SRef-ID: 1607-7962/gra/EGU2007-A-02809

Capture of solar wind alpha-particles by the Martian atmosphere

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Integration along He^{++} test-particle trajectories in the self-consistent electromagnetic fields generated by three-dimensional hybrid simulations of the solar wind/Mars interaction is used to evaluate the losses of solar wind α-particles due to charge-exchange processes. Approximately 30% of solar α-particles impacting the planetary cross-section are transformed into single-ionized and neutral helium, that corresponds to a total loss rate of He^{++} ions equal 6.7×10^{23} s^{-1}. The flux of helium neutral atoms, created by double electronic capture on exospheric oxygen, impacting the exobase, and penetrating below where it can be trapped, is about of 1.5×10^{23} s^{-1}. This implies an important role of the solar wind source in the helium balance of the Martian atmosphere. The implantation of the solar helium on Mars shows an asymmetry related to the orientation of the motional electric field of the solar wind. $-\boldsymbol{V}_{SW} \times \boldsymbol{B}_{IMF}$.