



Cross-terminator flow in the ionosphere of Mars

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The upper ionospheres of Mars and Venus are permeated by the magnetic fields induced by the solar wind. It is a long-standing question whether these fields can put the dense ionospheric plasma into motion. If so, the cross-terminator flow of the upper ionosphere could explain a significant part of the ion escape from the planets atmospheres. But it has been technically very challenging to measure the ion flow at energies below 20eV. The only such measurements have been made by the ORPA instrument of the Pioneer Venus Orbiter reporting speeds of 1-5km/s for O⁺ ions at Venus above 300km altitude at the terminator (Knudsen et al, GRL 1982). Since these observations could never be confirmed by other instruments they have been debated. We here report on new measurements of the cross-terminator ion flow at Mars by the ASPERA 3 experiment onboard Mars Express with support from the MARSIS radar experiment which confirm O⁺ flow speeds of around 6km/s with fluxes of $1.2 \cdot 10^9/\text{cm}^2\text{s}$. We also discuss the complicated influence of the spacecraft potential on low energy measurements. We discuss the implication of these new observation for ion escape and possible extensions of the analysis to dayside observations which might allow us to infer the flow structure imposed by the induced magnetic field.