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Ion Escape from Mars - Observations by Mars Express and MAVEN

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Abstract

Measuring the escape of ions from Mars has been one of the main targets of the ASPERA-3 experiment on Mars Express since orbit insertion in 2004. But the Mars Express spacecraft is not optimized for this measurement since it lacks a magnetometer and a Langmuir probe to observe magnetic field and total plasma densities. Nevertheless over the last 12 years several studies have been published attempting to determine the total escape flux and its variation with external parameters from ASPERA-3 observations [1, 2, 3]. Especially the contribution of the *cold ions* with energies of less than 5eV to the escape flux has been debated because it is most difficult to measure. Since October 2014 the MAVEN spacecraft is in orbit around Mars with a much larger instrumental suite optimized for measuring the ion outflow. In this paper we reassess observations made by the MEX ASPERA-3 and MARSIS experiments in the light of the MAVEN observations of tailside ion outflow observed between 2014 and 2017. We investigate the influence of the spacecraft potential on the derived flux values and compare ion density observations by the different MAVEN instruments.

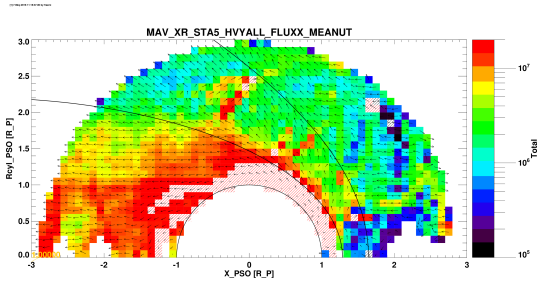

Figure 1: Mean flux of heavy ions (O+ & O2+) observed by MAVEN STATIC between 01 Dec 2014 and 15 Aug 2017, scaled in ions/cm2s. The vertical component of vectors shows the deviation from the cylindrical symmetry axis.

References

[1] Fraenz, M. et al. Plan.Space Science, 119, p.92-104, 2015

[2] Ramstad, R. et al. J.Geophys.Res, 10.1002/2017/JA024306, 2017

[3] Dubinin et al., J.Geophys.Res., 10.1002/2017JA024741, 2017