EPSC Abstracts
Vol. 10, EPSC2015-844, 2015
European Planetary Science Congress 2015

From MGS to MAVEN: Analysis of electron plasma voids through statistical and case study

M. Steckiewicz (1), C. Mazelle (1), N. André (1), P. Garnier (1), D.L. Mitchell (2), R. Lillis (2), J. McFadden (2), J. Connerney (3), L. Andersson (4), J. Luhmann (2), B. Jakosky (4), E. Penou (1), V. Génot (1), M. Bouchemit (1), E. Budnik (1), A. Biegun (1) A. Beth (1), A. Fedorov (1)

(1) CNRS, IRAP, Toulouse, France (2) Space Science Laboratory, Berkeley, USA (3) Goddart Space Flight Center, Washington DC, USA (4) Laboratory for Atmospheric and Space Physics, Boulder, USA

Contact: msteckiewicz@irap.omp.eu

Abstract

The Mars Atmosphere and Volatile Evolution spacecraft (MAVEN) entered in orbit around Mars on September 21st, 2014 and began its scientific phase two months later. Compared to its predecessors, i.e. Mars Global Surveyor which orbited around Mars at 400 km from 1999 to 2006, and Mars Express which has been around Mars since 2003 with a periapsis at 270 km, MAVEN will provide unprecedented observations of the neutral and plasma environment of the planet thanks to its unique orbital coverage and its sophisticated instrument suite. Its precessing orbit is highly elliptical with a 4.5h period and a nominal periapsis at 150 km with "deep-dip campaigns" down to 125 km. While MGS did not carry any ion spectrometer and MEX does not carry any magnetometer, MAVEN has a complete set of plasma instruments including the Solar Wind Electron Analyzer (SWEA) measuring the energy and angular distributions of electrons of energetic range from 3eV to 4.6 keV with a 2 seconds rate.

From November 2014 to February 2015 MAVEN's periapsis sampled northern latitudes from 30 to 70 degrees from the dawn to the dusk terminator in the night-side above regions with and without significant crustal magnetic sources. On nearly each periapsis a drop of more than two orders of magnitude of suprathermal electrons with energies above 3 eV can be observed. Electron plasma voids have already been reported from MGS and MEX observations and their location suggested a strong link with crustal magnetic sources on the surface of the planet that can generate magnetic loops excluding electrons. We will first revisit the properties of electron plasma voids from MGS and MEX observations and compare/contrast them with the new MAVEN multi-instrumental observations that reveal with unprecedented details the highly variable structure of these voids. Their numerous observations above the Northern hemisphere where crustal magnetic sources are much weaker than in the southern hemisphere reveal that additional generation mechanisms must be taken into account. We will then discuss the various possible origins of these electron plasma voids in relation to the variability of the nightside ionosphere of Mars.

References

[1] D.L. Mitchell, R.P. Lin, C. Mazelle, H; Rème, P.A. Cloutier, J.E.P. Connerney, M.H. Acuña, and N.F. Ness, Probing Mars' crustal magnetic field and ionosphere with the MGS Electron Reflectometer, JGR, vol. 106, NO. E10, Pages 23,419-23,427, 2001.