AOGS 2005

ENA emission from Saturn's magnetosphere and from Titan

IANNIS DANDOURAS[1], DONALD G. MITCHELL[2], EDMOND C. ROELOF[2], STAMATIOS M. KRIMIGIS[2], PONTUS C. BRANDT[2] and PHILIPPE GARNIER[1]

[1]*Centre d'Etude Spatiale des Rayonnements, CNRS/UPS, Toulouse, France*
[2]*Applied Physics Laboratory, Johns Hopkins University, Laurel, Maryland, USA*

Since the initial approach to Saturn and the first orbits around the planet, the Cassini spacecraft is providing a unique view of the Saturnian system, revealing a very dynamic magnetosphere [1]. The Ion and Neutral Camera (INCA), one of the three sensors that comprise the Magnetosphere Imaging Instrument (MIMI) [2] on the Cassini Saturn orbiter, images the ENA emissions from various ion/gas interaction regions in the Saturnian magnetosphere [3,4]. Singly-charged energetic ions from Saturn's magnetosphere undergo charge exchange collisions with neutral atoms from the gas clouds in the Saturnian system, being transformed into energetic neutral atoms (ENAs). MIMI also directly measures the parent energetic ion population in situ along the Cassini trajectory, using the CHEMS and LEMMS ion sensors.

In the vicinity of Titan energetic magnetospheric ions, gyrating in the local Saturnian magnetic field (distorted by the plasma/neutral interaction with Titan's nitrogen-rich exosphere), generate ENAs that emerge from the exosphere to form an image showing an irregular ENA halo around the moon. It exhibits a gap above the surface, reaches a maximum intensity at an altitude of a few thousand km, and then fades away with distance due to the decrease in exospheric density.

During Cassini's second orbit around Saturn the spacecraft performed the Ta Titan flyby (October 26, 2004), at an altitude of only 1174 km. INCA data acquired during this targeted close flyby [3] confirm model predictions of dominant finite ion gyroradii effects [5], but also reveal a much more complex interaction: maximum ENA emissions are originating at higher altitudes than predicted by a simple Chamberlain-type model of the Titan exosphere. The Tb Titan flyby (December 14, 2004) showed in addition a quite variable ENA output. These observations will be analysed and a simulation will be presented of some of the features they reveal.

Keywords: ENA; Saturn; Titan; Magnetosphere; Exosphere; Cassini

References

[1] S. M. Krimigis, et al., *Science,* **307**, 5713 (2005).
[2] S. M. Krimigis, et al., *Space Sci. Rev.,* **114**, in press (2005).
[3] D. G. Mitchell, et al., *Science*, submitted (2005).
[4] D. G. Mitchell, et al., *Geophys. Res. Lett.*, submitted (2005).
[5] J. Dandouras and A. Amsif, *Planet. Space Sci.,* **47**, 1355 (1999).