Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

PPS001-14 会場:101 時間:5 月 27 日 12:00-12:15

Global ENA Imaging of the Magnetospheres of Saturn and Jupiter
Global ENA Imaging of the Magnetospheres of Saturn and Jupiter

Pontus Brandt[1*], Donald G. Mitchell[1], Barry H. Mauk[1]
Pontus Brandt[1*], Donald G. Mitchell[1], Barry H. Mauk[1]

[1]JHU/APL
[1]JHU/APL

Jupiter's magnetosphere is by far the largest object in the sky if it would be visible from Earth. Its stellar-like transfer of angular momentum from the fast rotating planetary magnetic field to the space plasma environment is the engine that makes the Jovian magnetosphere also the biggest planetary particle accelerator within the solar system. Dense plasma originating from the Io and Europa region loads the fast rotating planetary magnetic field, stretching it into a magnetodisk until a multi-step process involving magnetic field ruptures (”reconnection”) and plasma instabilities accelerates ions and electrons up to 100 MeV that bombard the surfaces of moons.

EJSM has required a synergistic approach within the JGO-JEO constellation to unravel fundamental and universal magnetospheric processes such as these, by using powerful combinations of in-situ and global imaging measurement. The Japanese Space Agency is also considering a possible Jupiter Magnetospheric Orbiter (JMO), enabling triple point measurements and multi-point imaging to ensure simultaneous and continuous observations - a key requirement for revealing how the magnetosphere couples to the ionosphere as well as to the plasma sources.

Energetic Neutral Atom (ENA) imaging is so far the only technique capable of obtaining global images of the magnetospheric energetic ion population in the ˜3-300 keV range, which otherwise would have remained invisible. ENA cameras on Cassini and the terrestrial IMAGE mission have revealed global, explosive acceleration processes and their connection to the ionosphere, aurorae and radio emissions. Therefore, the technique is considered to be game-changing and one of the required measurement techniques in the payload definition for both JGO and JMO.

We present how ENA imaging has revealed the global magnetospheric dynamics of Saturn in a way that would not have been possible with only in-situ measurements. With this background we discuss how ENA imaging can be used at Jupiter to explore global acceleration, MI-coupling, relation to aurorae and radio emissions, transport, solar wind control, constrain torus neutral gas evolution and provide global context for moon-magnetosphere interactions. We use past measurements and a data-derived model to simulate ENA images through a realistic camera response function along the JGO orbit and explore the scientific value added by in-situ and imaging measurements from JMO. The presentation is concluded by summarizing the critical technical requirements of ENA cameras, such as energy and mass range, geometrical factor and background/foreground rejection that must be met in order to operate in the harsh Jovian environment while achieving the highest priority science objectives.