Geophysical Research Abstracts
Vol. 18, EGU2016-11610, 2016
EGU General Assembly 2016

Energetic Neutral Atom Imaging of the Lunar Poles and Night-Side

Audrey Vorburger (1), Peter Wurz (1), Stas Barabash (2), Martin Wieser (2), Yoshifumi Futaana (2), Anil Bhardwaj (3), Mb Dhanya (3), and Kazushi Asamura (4)

(1) University of Bern, Bern, Switzerland (vorburger@space.unibe.ch), (2) Swedish Institute of Space Physics, Kiruna, Sweden, (3) Space Physics Laboratory, Vikram Sarabhai Space Center, Trivandrum, India, (4) Institute of Space and Astronautical Science, Sagamihara, Japan

So far all reported scientific results derived from measurements of the Chandrayaan-1 Energetic Neutral Analyzer (CENA) on board the Indian lunar mission Chandrayaan-1 focused on the sun-lit part of the Moon. Here, for the first time, we present the analysis of the Moon – solar wind interaction in Energetic Neutral Atoms (ENAs) from measurements over the poles and the night-side of the Moon.

The Moon, not being protected by a global magnetic field or an atmosphere, is constantly bombarded by solar wind ions. Until recently, it was tacitly assumed that the solar wind ions that impinge onto the lunar surface are almost completely absorbed ($<$ 1% reflection) by the lunar surface (e.g. Crider and Vondrak [Adv. Space Res., 2002]; Feldman et al. [J. Geophys. Res., 2000]). However, recent observations conducted by the two ENA sensors of NASA's Interstellar Boundary Explorer and by Chandrayaan-1/CENA showed an average global energetic neutral atom (ENA) albedo of 10% – 20% (e.g. McComas et al. [Geophys. Res. Lett., 2009], Wieser et al. [Planet. Space Sci., 2009], Vorburger et al. [J. Geophys. Res., 2013]).

In the past 6 years, several studies have closely investigated this solar wind – lunar surface interaction from various viewpoints. The main findings of these studies include (1) the dependency of the hydrogen reflection ratio on the local crustal magnetic fields (e.g., Wieser et al. [Geophys. Res. Lett. ,2010] and Vorburger et al. [J. Geophys. Res., 2012]), (2) the determination of the energy spectra of backscattered neutralized solar wind protons (Futaana et al. [J. Geophys. Res., 2012]) (3) the use of the spectra shape to remotely define an electric potential above a lunar magnetic anomaly (Futaana et al. [Geophys. Res. Lett., 2012]), (4) the favouring of backscattering over forward-scattering of impinging solar wind hydrogen particles (Vorburger et al. [Geophys. Res. Lett., 2011]), (5) the first-ever measurements of sputtered lunar oxygen (Vorburger et al. [J. Geophys. Res., 2012]), (6) the first-ever observation of backscattered solar wind helium (Vorburger et al. [J. Geophys. Res., 2012]), and (7) the determination of the scattering properties of backscattered solar wind hydrogen measured when the Moon transversed Earth's magneto-sheath (Lue et al. [J. Geophys. Res., 2016]).

All findings above are based on measurements from the sun-lit side of the Moon's surface, where solar wind particles can impinge freely onto the lunar surface. On the night-side, in contrast, a large scale wake structure is formed as a result of the high absorption of solar wind plasma on the lunar day-side. Very recent ion measurements of Chandrayaan-1's Solar Wind Monitor (SWIM) have revealed the presence of protons in the near-lunar wake, though (Dhanya et al., [Icarus 2016 (submitted)]). The presence of protons in the near lunar wake implies that there is also some sort of solar wind – lunar surface interaction on the lunar night-side. A complete analysis of this interaction will be presented herein.