Geophysical Research Abstracts
Vol. 14, EGU2012-12220, 2012
EGU General Assembly 2012

Energetic Neutral Atom Imaging of the Lunar Surface

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Since the Moon is not shielded by a global magnetic field or by an atmosphere, solar wind plasma will impinge onto the lunar surface almost unhindered. Until recently it was assumed that almost all of the impinging solar wind ions are absorbed by the surface. However, McComas et al., GRL 2009, Wieser et al., PSS 2009, and Rodríguez et al., PSS 2012, presented observations made by the Interstellar Boundary Explorer (IBEX) and by Chandrayaan-1 that showed that up to 20% of the impinging solar wind ions are backscattered as energetic neutral atoms (ENAs). Since the energy of these backscattered ENAs is sufficiently high, the ENAs leave the lunar surface on ballistic trajectories and their trajectory can be reconstructed from the point of measurement to its origin on the lunar surface. This allows recording maps of ENAs backscattered from the lunar surface. For a quantitative analysis of the backscattered ENAs the angular scattering function has to be known. Schaufelberger et al., GRL 2011, recently published a mathematical description of the angular scattering function of the ENAs leaving the lunar surface based on CENA (Chandrayaan-1 Energetic Neutral Analyzer) measurements. This scattering function allows us to map the particles, which are measured at an altitude of 100 km and 200 km, respectively, back onto the lunar surface. The 7 angular sectors of CENA and Chandrayaan-1's polar orbit give us a good coverage of the lunar surface. We analysed all available CENA measurements and produced a global map of the neutral hydrogen atoms with energies in the range (19 – 740 eV) that are coming off the lunar surface.