The effect of solar wind parameters on proton backscattering from the Moon: Chandrayaan-1/SARA observations

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Backscattered solar wind protons from the lunar surface were first observed by Kaguya [1], at a backscattering efficiency of 0.1% – 1% of the incident solar wind proton flux. Subsequent observations by Chandrayaan-1 [2] and IBEX [3] revealed that a larger fraction (10% – 20%) of the solar wind protons is backscattered as energetic neutral hydrogen atoms. In the present study, we use observations from the Solar Wind Monitor (SWIM) of SARA on Chandrayaan-1 to investigate the backscattered proton fraction's dependence on the solar wind parameters. Our observations indicate a large variability in the proton backscattering fraction that strongly depends on the solar wind velocity ($\sim$0.01% to $\sim$1% for solar wind velocities of 250 to 550 km/s). The observed backscattered proton fluctuation agrees well with a model of proton survivability against neutralisation as a function of impact velocity, available from theoretical and laboratory studies [4]. This dependence on impact velocity is important to take into account when modelling the interaction between airless bodies and their surrounding plasma. An enhanced understanding of the particle-surface interaction may open up for remotely determining properties of the surface and/or the impacting particles.

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