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## **Solar wind interaction with the lunar surface: Observation of energetic neutral atoms on the lunar surface by the Advanced Small Analyzer for Neutrals (ASAN) instrument on the Yutu-2 rover of Chang'E-4.**

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A fraction of up to 20% of the solar wind impinging onto the lunar surface is reflected as energetic neutral atoms back to space, as established by remote sensing, e.g. by the SARA instrument on Chandrayaan-1 or by IBEX. Mapping of these reflected energetic neutral atoms to the surface opened a new way to remotely study the solar wind precipitation onto the surface. However, the high reflection rate remained an enigma given the high porosity of the lunar regolith, but no measurements directly on the surface were available.

With the Advanced Small Analyzer for Neutrals (ASAN) mounted on the Yuyu-2 the rover of Chang'E-4, for the first time measurements of the energetic neutral atom flux originating from the lunar surface were performed directly on the lunar surface itself. ASAN measures with a single angular pixel the energy spectrum of energetic neutral atoms reflected or sputtered from the surface with coarse mass resolution. ASAN uses the mobility of the rover to cover different solar wind illumination angles and scattering angles from the surface.

Since the landing of Chang'E-4 in the Von Kármán crater on the lunar far side in January 2019, ASAN has spent more than one year on the lunar surface and performed typically two measurement sessions per lunar day with nominal performance.

We review the ASAN instrument status and operations; present energy and mass spectra of energetic neutral atoms backscattered and sputtered from the surface, and discuss sputtering yields observed during different observation sessions. We put these observations into context of earlier remote sensing data by the SARA instrument on Chandrayaan-1.