





**ENA and lunar water** observations as studied by ARTEMIS, Chang'E and other space missions

(1) Backscattered as H<sup>+</sup> ~0.1-1% [Saito et al., 2008, 2010]
(2) Backscattered as H energetic neutral atoms (ENA) ~20% [Wieser et al., 2009; ]
(3) Combined with O to make OH/H<sub>2</sub>O ~79% [Pieters et al., 2009; McCord et al., 2011]
(4) Direct diffusion of hydrogen and recombinative desorption leading to the formation of H<sub>2</sub> [Farrell et al., 2017, Tucker et al., 2019]

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## 1. ENA (Chang'E 4) – Solar wind (ARTEMIS) observations



- ENA differential flux: positively correlated with solar wind flux, density, and dynamic pressure at Energy 105-523 eV.
- Dawnside > duskside



- ENA cutoff energy: dawnside > duskside.
- Solar wind may be **decelerated by duskside** ambipolar and Hall electrostatic fields within a lunar mini-magnetosphere. [Modeled by Xie et al., 2021]



- Electrostatic potential range: 50–260 V.
- Deceleration rate of the solar wind: 12%–18%.

[Wang et al., 2021a, ApJL] **\*\* The dawn-dusk asymmetry observed by Chang'E 4 was caused by lunar mini-magnetosphere.** https://doi.org/10.3847/2041-8213/ac34f3

## 2. Lunar water (Chandrayaan-1)-Earth wind(ARTEMIS and KAGUYA) Observation



[Wang et al., 2021b, ApJL] **\* Earth Wind could be a Possible Source of Lunar water.** https://doi.org/10.3847/2041-8213/abd559