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# Observations and Comparative Analyses of Sodium in Mercury's and the Moon's Exospheres

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Both Mercury and the Moon possess tenuous, collisionless "atmospheres", known as "exospheres". Mercury's proximity to the Sun, coupled with the absence of a dense atmosphere, exposes its surface to intense solar wind, solar radiation, energetic particles, and interplanetary meteoroid impacts. These interactions contribute to the formation and variability of its surface-bound exosphere. The Moon experiences similar exospheric production mechanisms.

In 1985, sodium was first detected in Mercury's exosphere (Potter & Morgan, 1985). Through ground-based observations with the spectrometer, Potter and Morgan resolved the spectra and found the sodium D lines performed in their measurements, with the surface density estimated to be 1.5 × 10^5 cm^−3. Afterwards, a similar detection in the Moon's exosphere followed (Potter & Morgan, 1988). Subsequent studies predicted (Ip, 1986; Smyth, 1986) and later confirmed (Potter, Killen & Morgan, 2002) the elongated structure of Mercury's sodium exosphere due to solar radiation pressure acceleration, revealing an extended tail and bimodal high-latitude distributions.

While the Moon's sodium exosphere, when viewed in an Earth-centered coordinate frame, exhibits a projected sodium spot with an angular size of approximately 3◦ ×3◦ (Smith et al., 1999) in the anti-sunward direction. This feature has been observed using all-sky cameras (Matta et al., 2019; Baumgardner et al., 2021), highlighting the role of radiation pressure and surface interactions in shaping its distribution.

We have conducted a series of observations on both Mercury's sodium tail and the Moon's sodium spot by different approaches, utilizing different system of instruments. Our goal is to explore Mercury's sodium exosphere based on our own observations and refine the lunar sodium exospheric model with our data. Combining the observations of Mercury's and Moon's sodium, we can first understand the spatial distributions and characteristics of sodium exospheres, so as to probe into the surface processes of solar system objects.

## Section

Solar System/Exoplanets

**Primary author:** HSU, Chen-Yen (IANCU)

**Co-authors:** LAI, Ian-Lin (IANCU); IP, Wing-Huen (IANCU)

**Presenter:** HSU, Chen-Yen (IANCU)

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