

## **Calcium in Mercury's Exosphere: Modeling MESSENGER Data**

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Although neutral calcium in Mercury's exosphere was discovered by ground-based observations, the Mercury Atmospheric and Surface Composition Spectrometer (MASCS) on MESSENGER has made the first high spatial resolutions of Ca in the tail region anti-sunward of Mercury and over both poles. We use a Monte Carlo model of the exosphere to track the trajectories of Ca atoms and molecules ejected from the surface until they are photo-ionized or dissociated, escape from the system, or stick to the surface. This model allows us to understand the exospheric source processes and interactions between the neutrals, solar radiation, Mercury's magnetosphere, and the planetary surface.

The MASCS data have suggested a stable, high energy source of Ca that is enhanced in the dawn, equatorial region. While the origin of the asymmetry in the production flux is uncertain, high energy calcium atoms can be supplied through a two step process: molecular calcium (CaO, for example) may be ejected by impact vaporization, sputtering, or some other process. CaO quickly photo-dissociates (within a few minutes), producing atomic Ca with ~2 eV excess energy, equivalent to 3 km/s. While this is less than Mercury's escape velocity (4.3 km/s), radiation pressure pushes Ca produced near the terminator into the tail. We will show the results of simulations of possible source processes. A better understanding of calcium source mechanism will be possible once MESSENGER enters Mercury orbit and MASCS measures the global distribution of exospheric calcium.