MODELING OF METALS IN THE HERMEAN EXOSPHERE: PREDICTIONS FOR THE MASS SPECTROMETER STROFIO ONBOARD BEPICOLOMBO. C. Grava and S. A. Livi, Southwest Research Institute, 6220 Culebra road, San Antonio, TX, 78238, USA (cgrava@swri.edu).

Introduction: Mercury's exosphere is created by the interaction between external drivers (solar wind or magnetospheric plasma, micrometeoroids, and solar photons) and Mercury's surface. The characteristics and dynamics of Mercury's exosphere therefore depend on the process with which the species were ejected (thermal desorption, electron- and photon-stimulated desorption, micrometeoroid impact vaporization, and ion sputtering), and each species creates its own, independent, exosphere. Source and loss processes have different relative importance depending on the species considered, on the local time, and on the position of Mercury along its orbit [1,2]. The Mercury Surface, Space Environment, Geochemistry, and Ranging (MESSENGER) spacecraft, which orbited Mercury between 2004 and 2015, improved our understanding of the Mercurian exosphere, shedding light on the connection between the external environment and the exosphere (e.g., the dust stream of comet Encke is responsible for the unusual spike of Ca [3,4]), discovering Mg [5], Al, and Mn [6], but also leaving us with open questions (e.g. why O density is so low compared to stoichiometric predictions?)

BepiColombo: BepiColombo is the next step in the Mercury exploration. A twin spacecraft developed by ESA and JAXA, BepiColombo [7] will be launched in October 2018 and will start a 1-year mission to Mercury in 2025, where it will study the surface-exosphere-magnetosphere environment in unprecedented detail [8]. Both spacecraft will share the same periherm (~400 km altitude). The Mercury Magnetosphere Orbiter (MMO), on an elongated orbit with apoherm of ~12,000 km, will study Mercury's magnetosphere, while the Mercury Planetary Orbiter (MPO), with apoherm of ~1500 km altitude, will focus on Mercury's exosphere.

Strofio: SERENA [9] is a suite of 4 instruments onboard MPO that will map the ion and neutrals of both Mercury's exosphere and the solar wind. Of these 4 instruments, Strofio is a mass spectrometer that will measure ions and neutrals with high mass resolution ($m/\Delta m \sim 100$ at mass 18). It will be the first mass spectrometer to ever measure *in situ* the composition of Mercury's exosphere. Because of the relatively high altitude of the periherm, Strofio will be especially sensitive to neutrals that were lifted off the surface with enough energy to reach the instrument. Many of these neutrals are metals, including the refractories Ca and Mg and the volatiles Na and K, ejected from the surface by energetic processes such as ion sputtering and micrometeoroid impact vaporization. The density measured by Strofio will be convolved with the MPO velocity, since Strofio aperture is in the ram direction of the spacecraft.

Our code: To help planning the observations and maximize the scientific return of Strofio, we developed a Monte Carlo code that tracks several test particles along their ballistic trajectories until they are lost (e.g. via photo-ionization). The code was originally developed for Ar on the Moon [10], which is ejected primarily with thermal desorption, and has been modified to include other species and other ejection processes. The model output includes the density and the energy distribution of neutrals as a function of latitude, altitude, and local time. By convolving the resulting densities with Strofio's response function (depending on MPO's velocity), it is possible to predict the density actually measured by it as a function of latitude, altitude, and local time.

We will present "a day at Strofio" for several species (Si, Na, K, O, etc.), to show that the density and velocity distribution inferred by Strofio will constrain the relative importance of source and loss processes for several species.

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