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Strofio: Exospheric Sampling of Mercury's Surface Composition

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ESA's BepiColombo mission to the planetary Mercury includes a comprehensive set of advanced instruments. Strofio, one of the instruments on the SERENA neutral and ionizing particle suite on the Mercury Planet Orbit (MPO), is a high mass resolution, time-of-flight system for low energy neutral particles. Key questions addressed by Strofio are: * What are the composition, isotopic abundance, spatial distribution, and temporal variability of the neutral particles in Mercury's exosphere? * How do the surface, exosphere, and magnetosphere interact? * What is the chemical composition of Mercury's surface? Strofio takes advantage of the direct coupling between the neutral atoms in the exosphere and their source regions in the outer layers of the regolith to answer fundamental questions about Mercury, its highly variable exosphere and its small but dynamic magnetosphere. In each case Strofio is either the only proposed BepiColombo investigation that can make these discoveries or it is the investigation that can return the highest quality, most definitive result.

The MPO spacecraft's low-altitude (400 Œ 1500 km) polar orbit provides Strofio a unique opportunity to measure the in situ composition of the very tenuous and highly variable Mercurian exosphere. In Mercury's surface-bounded exosphere, the neutral particles move on Keplerean trajectories and mostly return to the surface. Strofio will obtain the first direct measurements of the absolute abundances, both chemical and isotopic, of all exospheric neutral particles. The temporal and spatial variability of the exosphere will be integrated within models of the coupled system (surface, exosphere, magnetosphere). These data-driven models will enable us to understand the different processes responsible for ejecting the atoms from the surface, and ultimately will allow us to infer Mercury's surface composition.