3-D Simulations of Mercury's Exosphere Environment

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It is intended to measure Mercury's surface mineralogical composition by in-situ measurements of exospheric particle densities with the Particle Analyzer Ion Spectrometer sensors ELENA, STROFIO, MIPA and PICAM, of the SERENA instrument on board of ESA's BepiColombo planetary orbiter MPO. Because the expected exospheric densities are very small and the various exosphere source processes are located at different locations over Mercury's surface, we developed a three dimensional exospheric model to see whether the measurement of exospheric particles by the SERENA-instruments is feasible along the MPO spacecraft orbit. We model energy and ejection angle distributions of the particles at the surface, with the emission process determining the actual distribution functions. Our model follows the trajectory of each particle by numerical integration until the particle hits Mercury's surface again or escapes from the calculation domain. By using a large set of these trajectories, bulk parameters of the exospheric gas are derived, e.g., particle densities for various atomic and molecular species. First results of the 3-D simulations are presented and discussed in the frame of the mission objectives.