Comparing the atmospheres of mercury and the earth's moon

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Abstract. The exospheres of Mercury and the Earth's Moon are fundamentally similar, but the differences that do exist between them can help us to develop a better understanding of the processes at work on the two bodies that produce and remove volatiles. The major differences are derived from (1) the different compositions of the two surfaces, (2) the different particle and field environments above the surface of each body (particularly the presence of intrinsic magnetic field of Mercury), and (3) the larger flux of interplanetary dust incident at the orbit of Mercury. The first difference, surface composition, is the most intractable problem, but the most challenging part of that problem, the composition of the Hermean regolith, may be at least partially addressed as the MESSENGER mission completes work over the next year. Much progress has been made with respect to exploring the second difference above--spacecraft such as Helios, Ulysses, WIND, and ACE have measured the solar wind and its composition both in Earth orbit and at distances encompassing the orbit of Mercury. While our knowledge of the solar wind is incomplete, again it is far more detailed than a simple $1/R^2$ law would predict. Another problem is that of the flux of charged particles to the surfaces. While Mercury's magnetosphere is the subject of current study with MESSENGER, the influx of charged particles on the Moon has gone beyond a cos ψ picture, where ψ is the solar zenith angle. We know that the influx of ions at the Moon is affected by magnetic anomalies, by craters, and by surface charging. The third external difference is the differing flux of interplanetary dust incident on the two surfaces. In this talk we will consider: (1) the species that one can compare now for these two exospheres (Na, K, and He); (2) the species that you might be able to compare with future measurements (Ca and Mg); and (3) how intensive ground-based observations of the easiest lunar species to observe from the ground, Na and K, might help us address source processes at work on both surfaces. We will discuss current and planned modeling efforts for both the lunar and Hermean exospheres, and some current and planned observations, both ground-based and space-based.