

Sodium Velocity Maps on Mercury

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The objective of the current work was to measure two-dimensional maps of sodium velocities on the Mercury surface and examine the maps for evidence of sources or sinks of sodium on the surface. The McMath-Pierce Solar Telescope and the Stellar Spectrograph were used to measure Mercury spectra that were sampled at 7 milliAngstrom intervals. Observations were made each day during the period October 5-9, 2010. The dawn terminator was in view during that time.

The velocity shift of the centroid of the Mercury emission line was measured relative to the solar sodium Fraunhofer line corrected for radial velocity of the Earth. The difference between the observed and calculated velocity shift was taken to be the velocity vector of the sodium relative to Earth. For each position of the spectrograph slit, a line of velocities across the planet was measured. Then, the spectrograph slit was stepped over the surface of Mercury at 1 arc second intervals. The position of Mercury was stabilized by an adaptive optics system. The collection of lines were assembled into an images of surface reflection, sodium emission intensities, and Earthward velocities over the surface of Mercury. The velocity map shows patches of higher velocity in the southern hemisphere, suggesting the existence of sodium sources

there. The peak earthward velocity occurs in the equatorial region, and extends to the terminator. Since this was a dawn terminator, this might be an indication of dawn evaporation of sodium. Leblanc et al. (2008) have published a velocity map that is similar.

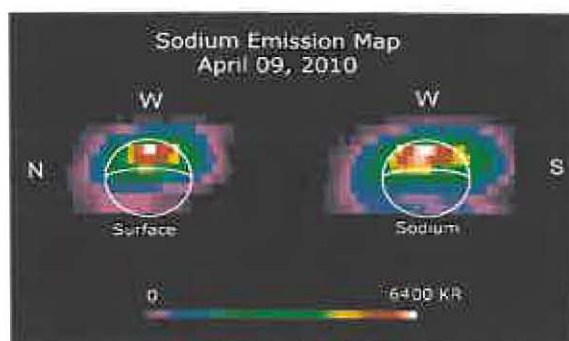


Figure 1. Surface reflection for Mercury (left) and sodium intensity (right) observed April 9, 2010.

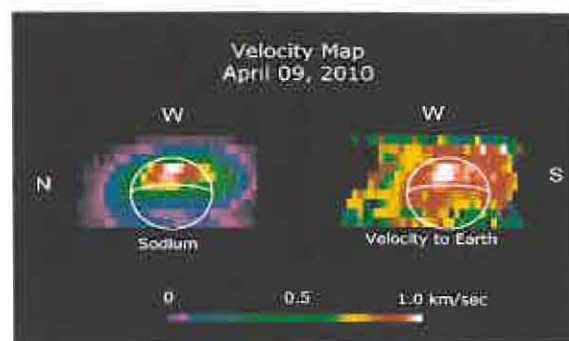


Figure 2. The velocity map for the sodium observed in Figure 1, shown on the right.

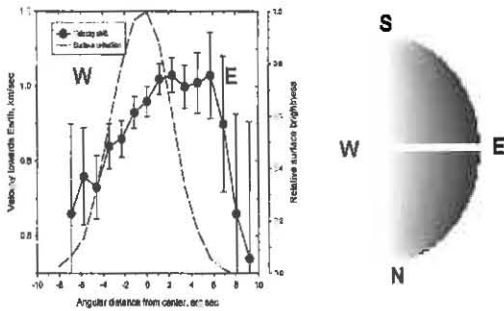


Figure 3. Observed earthward vectors for the east/west slice. The velocity map shows sodium flowing upward away from the planet.

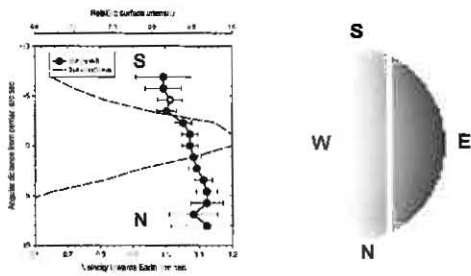


Figure 4. Observed earthward vectors for the north/south slice show an asymmetry north/south.

References.

Potter, A.E. et al. *Icarus*, 2009, 204, 353-367
 Leblanc, F., et al. *Geophys. Res. Letters*,
 2008, 35, cite ID L18204.

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