Geophysical Research Abstracts
Vol. 18, EGU2016-16736-4, 2016
EGU General Assembly 2016

Insolation and Resulting Surface Temperatures of the Kuiper-Rudaki Study Region on Mercury.

Karin E. Bauch (1), Harald Hiesinger (1), Mario D'Amore (2), Jörn Helbert (2), and Julia Weinauer (1)

(1) Westfälische Wilhelms-Universität Münster, Institut für Planetologie, Münster, Germany (karin.bauch@uni-muenster.de),
(2) DLR-Institut für Planetenforschung, Berlin, Germany

The imaging spectrometer MERTIS (Mercury Radiometer and Thermal Infrared Spectrometer) is part of the payload of ESA's BepiColombo mission, which is scheduled for launch in 2017 [1]. The instrument consists of an IR-spectrometer and radiometer, which observe the surface in the wavelength range of 7-14 and 7-40μm, respectively. The four scientific objectives are to a) study Mercury's surface composition, b) identify rock-forming minerals, c) globally map the surface mineralogy and d) study surface temperature and thermal inertia [1, 2].

In preparation of the MERTIS experiment, we performed detailed thermal models of the lunar surface, which we extrapolated to Mercury. In order to calculate insolation and surface temperatures, we use a numerical model, which has been described by [7]. Surface temperatures are dependent on the surface and subsurface bulk thermophysical properties, such as bulk density, heat capacity, thermal conductivity, emissivity, topography, and albedo.

Lunar and Mercurian surface temperatures show the same general characteristics. Both have very steep temperature gradients at sunrise and sunset, due to the lack of an atmosphere. However, there are major differences due to the orbital characteristics.

On Mercury the 3:2 resonant rotation rate and the eccentric orbit causes local noon at longitudes 0° and 180° to coincide with perihelion, which leads to "hot poles". At longitudes 90° and 270°, local noon coincides with aphelion, which results in "cold poles" [8]. At these longitudes brief secondary sunrises and sunsets are visible, when Mercury's orbital angular velocity exceeds the spin rate during perihelion [8].

Here we present diurnal temperature curves of the Kuiper-Rudaki study region, based on thermophysical estimates and MESSENGER (Mercury Surface, Space Environment, Geochemistry, and Ranging [9]) albedo data with a resolution of 1000m/px. Our study region spans more than 90° along the equator, thus allowing us to study both, hot and cold poles along the equator. The region shows smooth plains surrounding crater Rudaki (~120km), as well as cratered terrain around the prominent crater Kuiper (~60km) and has been extensively covered by measurements during the MESSENGER mission. Temperatures range from about 100K during the night to 570K (cold pole) and 700K (hot pole) at local noon. The floor of Kuiper crater reaches temperatures of ~660K at local noon, while those at Rudaki crater are 625K (+/-5K). Due to their higher albedo, the rays of Kuiper crater are about 5K colder than the surrounding regions. These temperature estimates will aid the accurate interpretation of future MERTIS spectra of the region obtained during the BepiColombo mission [10].

References: [1] Hiesinger, H. et al. (2010), *PSS 58*, 144-165. [2] Helbert, J. et al. (2005), *LPSC XXXVI*, #1753. [3] Keihm, S.J. and Langseth, M.G. (1973), *Proc. Lunar Sci. Conf.* 4^{th}, 2503-2513. [4] Lawson, S.L. et al. (2000), *JGR 105*, E5, 4273-4290. [5] Pieters, C.M. et al. (2009), *Science 326*, 568-572. [6] Paige, D.A. et al. (2010), *Space Sci. Rev 150,* 125-160. [7] Bauch, K.E. et al. (2014), *PSS* 101, 27-36. [8] Vasavada, A. et al. (1999), *Icarus 141*, 179–193. [9] Solomon, S.C. et al. (2008), *Science 321*, 59–62. [10] D'Amore et al. (2013), AGU, #P13A-1735.