Visible and infrared study of comet 2P/Encke's nucleus during its 2013 apparition

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The 2013 apparition of comet 2P/Encke provided an opportunity to study the comet while it was relatively close to the Earth. The comet passed 0.48 au from the Earth on October 17, the closest such passage since 2003 and until 2030. We initiated a visible and infrared observational campaign for the apparition with the goal of further characterizing the physical, thermal, and rotational properties of the P/Encke nucleus.

While thermal-emission data on the nucleus have been obtained in the past (e.g. [1–4]), observations in 2013 timed to coincide with an equator-on view afforded us the chance to have a rarely-seen vantage point of the nucleus. Low-resolution spectra over wavelengths from 0.7 to 2.5 µm were obtained over four nights (UT Sept. 26, 28, 30, Oct. 1) that span all of the nucleus rotational longitudes. The spectra were acquired at the NASA Infrared Telescope Facility (IRTF) using its SpeX instrument, and they sample reflected sunlight at the short wavelengths and Wien-side thermal emission at the long wavelengths. We will present results on thermal inertia and albedo from a preliminary analysis of these data.

We have shown through observations over the past 13 years that the rotation period of P/Encke's nucleus changes by about 4 minutes per orbit [5,6]. Furthermore, the typical lightcurve has the normal two-humped shape but with humps that have vastly different amplitudes (e.g., [7]). Thus, the equator-on view gave us the chance to further investigate P/Encke's rotation state and shape. We obtained visible-wavelength photometry of the nucleus in the R band at NASA/IRTF with the MORIS instrument on the aforementioned dates, at the NOAO Kitt Peak 2.1-meter telescope over UT Sept. 11, 12, 13, and 14, and at the CSUSB Murrillo Family Observatory 0.5-meter telescope over several dates in Sept. and Oct. [8]. The MORIS data in particular gave us the rotational context and absolute flux calibration for the spectra. We will present new, preliminary constraints on the secular changes in the nucleus spin state and on the nucleus shape.

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References: [1] Y. R. Fernandez et al. 2000, Icarus 147, 145. [2] M. S. Kelley et al. 2006, ApJ 651, 1256. [3] Y. R. Fernandez et al. 2008, BAAS 40, #16.24 [abstract], presented at 40th Meeting of the DPS. [4] P. Abell et al. 2009, BAAS 41, #20.02 [abstract], presented at 41st Meeting of the DPS. [5] B. E. A. Mueller et al. 2008, BAAS 40, #16.25 [abstract], presented at 40th Meeting of the DPS. [6] N. H. Samarasinha and B. E. A. Mueller 2013, ApJ 775, L10. [7] Y. R. Fernandez et al. 2005, Icarus 175, 194. [8] L. M. Woodney et al. 2013, BAAS 45, #413.25 [abstract], presented at 45th Meeting of the DPS.