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Deep Impact Photometry of Comet 9P/Tempel 1

JIAN-YANG LI[1], DEEP IMPACT SCIENCE TEAM[1]

[1] *Department of Astronomy, University of Maryland at College Park, MD 20740, USA*

We report the results from the photometric analysis of comet 9P/Tempel 1 from the disk-resolved images returned by Deep Impact (DI) during its encounter with the comet prior to the successful impact experiment. Disk-integrated brightness of the nucleus at visible wavelengths from 309 nm to 950 nm shows a linear spectrum without any spectral features at the spectral resolutions of those images (10 nm - 100 nm). The red slope is 12+/-2%. The disk-resolved photometric analysis with Minnaert's model gives out a Minnaert's slope parameter k of 0.66, with no wavelength dependence. The Hapke's modeling results in a single-scattering albedo (SSA) of 0.036+/-0.005 at 550 nm, and a linear SSA spectrum resemble the disk-integrated spectrum of the nucleus, with a slope of 12%. The global photometric roughness parameter is found to be about 20 deg, independent of wavelength. The albedo variations are very subtle across the sun-lit visible disk in the DI images, with an FWHM of 12%, and a unimodal histogram. Some small areas (3% of the projected area) are brighter than the rest by a factor of 1.8 to 2.2 from the IR to UV. The color variations of the nucleus are only 3%, with the small brighter areas relatively bluer, evident of the existence of water ice exposed on the surface. Although very subtle, the color variations show some correlations with the surface morphology. Global albedo maps show evidence of a relatively higher roughness parameter of about 30 deg, for small areas close to the southeast end of the nucleus in DI images.