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Comet 8P/Tuttle: A portrait of a contact-binary nucleus from Hubble and Spitzer space telescopes observations

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We detected the nucleus of comet 8P/Tuttle, a nearly-isotropic comet (NIC) in a 13.5∼yr orbital period, during its 2007–2008 close (0.25∼AU) Earth encounter with the Planetary Camera 2 of the Hubble Space Telescope(HST on 10-11 December 2007 and with the infrared camera (MIPS) of the Spitzer Space Telescope (SST) on 22-23 June 2008, sampling the rotational period of the nucleus. We determined a synodic rotational period of 11.40 +/-0.12 h and, by combining with the radar observations of Harmon et al. (2010), a sidereal rotation period of 11.444 +/-0.001h.

The visible and thermal light curve exhibit a complex shape best modeled by a contact-binary as evidenced by the radar observations. By combining these light curves and adding a constraint on the thermal inertia coming from millimetric observations at the Plateau de Bure Observatory, we determined the shape and size of the binary system approximated by two spheres in contact with respective radius of 2.56 and 1.1 km, a common albedo in the range 0.04 to 0.054 and a linear phase coefficient in the range 0.033 to 0.04 mag/deg. These results suggest a strong similarity of the properties of the nuclei of ecliptic and nearly-isotropic comets. We found that the shape model resulting from the radar observations is incompatible with both the HST and SST observations. A partial agreement could be obtained by assuming very different albedos of the two components, in a ratio of at least 5.