PRODUCTION RATES, JET MODELING, AND THE CONTINUED SPIN-DOWN OF COMET 10P/TEMPEL 2

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Overview: We report on our multiepoch observations (photometry and imaging) of Comet 10P/Tempel 2, primarily from Lowell Observatory. We find strong seasonal effects, a “typical” composition, and a change in the rotation period in 2010 consistent with our predictions based on the 1988 and 1999 rotation periods. We use the coma morphology and Monte Carlo numerical modeling to find a pole solution and constrain the latitude of the source region(s).

Photometry: We obtained narrowband photometry during the 1984, 1988, 1999, and 2010 apparitions. Tempel 2 exhibited a rapid “turn on” in activity ~90 days prior to perihelion, with the date of turn on varying somewhat from apparition to apparition. Peak production was achieved ~30 days after perihelion, with production decreasing gradually thereafter. The composition was “typical”, in agreement with our own earlier work [1] as well as those of other authors.

Lightcurve: We measured the nucleus lightcurve on 17 nights from 2010 September through 2011 January. This yielded a nucleus rotation period of 8.950 ± 0.002 hr, distinctly different from the rotation periods in 1999 (8.941 ± 0.002 hr) [2] and 1988 (8.932 ± 0.001 hr) [3 and references therein]. This continued spin-down marks the first time a comet nucleus has been shown to sustain a change in period over multiple apparitions, and is presumably due to asymmetric torquing caused by outgassing.

Coma Morphology: We obtained 25 nights of imaging in 1999 and 27 nights of imaging in 2010/11. Tempel 2 exhibited a single, fan-like jet in both gas and dust images. The orientation of the jet varied due to changing viewing geometry during each apparition, but there was little to no change in jet morphology during a rotation period, implying that the source region producing it is near the pole. The pole solutions derived from R and CN data differ systematically, and we adopt RA=162°, Dec=+58° as the preferred solution for the ensemble. Numerical Monte Carlo jet modeling (cf. [4]) to match the observed coma morphology and contrain the location of the source region(s) is ongoing and new results will be reported.

References: [1] A’Hearn et al. (1995) *Icarus*, *118*, 223-270. [2] Knight et al. (2011). *AJ*, *141*, 2. [3] Sekanina, Z. (1991) *AJ*, *102*, 350-388. [4] Schleicher D.G. and Woodney L. M. (2003) *Icarus*, *162*, 190-213.

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