Near- and Mid-Infrared Spectroscopy of Comet-Asteroid Transition Object 944 Hidalgo: Evidence for a Cometary Nature

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Dynamical arguments indicate that 944 Hidalgo is most likely an extinct or dormant comet. Hidalgo's Tisserand invariant (T = 2.07) suggests strongly that this object came either from the Kuiper belt or the Oort cloud (e.g., Weissman et al. 2002). In the visible, Hidalgo is classified as a D-type asteroid; to better understand its origin, we obtained near-infrared (ground based) and mid-infrared (Spitzer) spectra. In the near-infrared, Hidalgo's spectrum does not match (is redder than) those of primitive (P- and D-type) main-belt asteroids. In the 0.8 to 2.5 micron region, Hidalgo is similar to some Jupiter Trojans (D-types) and identical to one cometary nucleus (Emery et al. 2003 and Campins et al. 2006, respectively). The 7 to 35 micron spectrum of Hidalgo has silicate emission features qualitatively similar to those observed in Comet Hale-Bopp and other comets; Hidalgo's spectral shape is also very similar to those of several Jupiter Trojan asteroids (Emery et al 2006). Finally, our spectral results agree with those of Licandro et al. (2008). Their study of asteroids in cometary orbits found a significant anti-correlation between the Tisserand parameter and the spectral slope in the visible and near-infrared, meaning that the reddest objects have a lower Tisserand parameter (i.e., higher chance of a cometary origin). In conclusion, our ground-based and space-based spectra support dynamical arguments of a cometary origin for Hidalgo. Our results are also consistent with a simlar formation and evolutionary environment for Jupiter-family comets and Jupiter Trojans; i.e., all these objects may have formed in the Kuiper Belt as suggested by dynamical models (Morbidelly et al. 2005, Levison et al. 2008).