Analysis of classical Kuiper-belt objects and Haumea collisional family from the Herschel and Spitzer observations

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We have analyzed space-based data at far-IR wavelengths in order to determine physical properties of Kuiper-belt objects (KBOs), also known as transneptunian objects (TNO), in the dynamical class of classical Kuiper-belt objects (CKBO). This dynamical class also contains most of the Haumea family members, the only known collisional family among TNOs. We observed 44 CKBOs in the Herschel open time key program "TNOs are are Cool" (Müller et al. 2009). We use Herschel/PACS/photometer data (70, 100, 160 µm) combined with earlier Spitzer/MIPS (24 and 70 µm) data when available. Additionally, half a dozen CKBOs have data only from Spitzer. We have re-examined absolute visual magnitudes based on various optical data in the literature. We determine sizes, geometric albedos and beaming factors using the radiometric technique. The CKBOs with radiometrically measured diameters are in the size range $130 < D < 1430$ km.

Our results (Vilenius et al. 2014) confirm the correlation between inclination and size for dynamically hot CKBOs, previously extrapolated from an optical-brightness vs inclination trend. The average geometric albedo of dynamically cold CKBOs (at inclination <4.5 deg) is confirmed to be higher (0.14) than that of dynamically hot CKBOs (0.085, excluding Haumea family and dwarf planets). We have measured the albedo of three confirmed Haumea family members 2003 OP_{32}, 2003 UZ_{117} and 2005 RR_{43} which have high albedos but somewhat lower than the other known albedos within the family: Haumea has 0.804 (Fornasier et al. 2013) and 2002 TX_{300} has 0.88 (based on occultation, Elliot et al. 2010). We present size distributions of dynamically cold and hot CKBOs, which are based on measured sizes and debiasing to account for biases in discoveries and target selection (Vilenius et al. 2014). The characteristic sizes, and the size of the largest object, are smaller for dynamically cold CKBOs. This is compatible with the hypothesis that dynamically cold CKBOs formed at a larger heliocentric distance. The number of binaries among CKBOs is relatively high, especially among dynamically cold CKBOs. Most of the CKBO density estimates available have been derived using the sizes based on far-IR data and the radiometric technique (Vilenius et al. 2012, 2014, Fornasier et al. 2013).

References: Fornasier et al. 2013, Astronomy & Astrophysics 555, A15; Elliot et al. 2010, Nature 465, 897; Müller et al. 2009, Earth, Moon, Planets 105; Vilenius et al. 2012, Astronomy & Astrophysics 541, A94; Vilenius et al. 2014, Astronomy & Astrophysics, accepted.