The Size Distribution of Cometary Nuclei

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We are conducting a program of ground-based CCD photometry of distant cometary nuclei, in order to estimate their sizes, shapes, rotation periods and axial ratios. We have combined our data with that reported in the literature by other observers to obtain an estimate of the size distribution of observed Jupiter-family and Halley-type comets. The catalog consists of 79 measurements of 52 JF and HT comets using a variety of techniques, including CCD photometry, IR photometry, and HST imaging. The data has been normalized to an assumed albedo of 0.04 except in cases where the albedo was directly measured. We find that the cumulative number of comets at or larger than a given radius can be described by a power law function with a slope of -1.40 ± 0.03. This corresponds to a slope of -0.28 ± 0.01 for the cumulative luminosity function, close to the slope of -0.32 ± 0.02 found by Lowry (2001), derived from a homogeneously reduced CCD survey of distant JF comets. Both values are considerably less than the slope of -0.53 ± 0.05 found by Fernández et al. (1999). This inconsistency is most likely attributed to the inhomogeneous nature of the Fernández et al. dataset, and the inclusion of active comets within their sample. Typical values of the CLF slope for Kuiper belt objects are –0.64 to –0.69 (Gladman et al. 2001; Trujillo et al. 2001). The shallower slope of the JF and HT comets, which are considerably smaller than the measured Kuiper belt objects, may be due to intrinsic differences in the KBO size distribution at the different size ranges (Weissman & Levison 1998) or to the physical evolution of JF and HT comets as they lose mass through sublimation and fragmentation (Lowry 2001). This work was supported by the NASA Planetary Astronomy and Planetary Geology & Geophysics Programs. Support from the National Research Council is also gratefully acknowledged.