# Densities of distant binaries: Constraints from Spitzer

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We have observed 19 binaries classified as trans-Neptunian or Centaur objects using the Spitzer Space Telescope (SST). These observations, at wavelengths of 24 and 70 μm, are sensitive to the system-integrated thermal emission from the targets (SST is not capable of resolving these systems). Seven of the systems were detected at a signal-to-noise ratio > 5 in one or both bands, allowing their diameters to be determined to an accuracy of ≈15%. The detections of the other 12 objects are lower quality, but in some cases provide meaningful constraints on their size. Separate observations of these systems with the Hubble Space Telescope (HST), and in a few cases with Keck, constrain the binary orbital parameters, and therefore the system mass.

By combining the mass and diameter, we derive system-average densities. These densities provide some of our first observation-based insights into the bulk composition and internal structure of these primitive, icy bodies. Spitzer-derived densities have been reported previously by Grundy et al. 2007a (65489 Ceto, 1.4±0.45 g/cc), Grundy et al. 2007b (42355 Typhon, 0.44±0.2 g/cc), Stansberry et al. 2006 (47171 (1999 $TC_{36}$), 0.5±0.3 g/cc), and Spencer et al. 2006 (26308 (1998 SM165), 0.5±0.2 g/cc). Spitzer-based diameters for 136108 (2003 $EL_{61}$, 1150±200 km) and 136199 Eris (2600±300 km) are in accord with the diameters reported for those objects by Rabinowitz et al. (2006: 1350±150 km) and Brown et al (2006, 2007: 2400±100 km). The resulting densities for 2003 $EL_{61}$ and Eris are 2.6 g/cc and 2.3 g/cc. The low density of 47171 (1999 $TC_{36)}$ has recently been revised slightly upward (≈0.7 g/cc) by re-observation with Spitzer. These results reveal significant diversity in the densities of TNOs and Centaurs, as well as remarkably low densities for some of them, a result consistent with the conclusions of Lacerda and Jewitt (2007) based on their analysis of rotational lightcurves.

We will summarize the current status of our Spitzer and Hubble programs to observe binaries in the outer solar system, present new results for a few objects with newly acquired observations, and discuss the need to improve the sample for which we have reliable diameters and densities.

References:

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