

**COMETARY DEBRIS TRAILS: RELICS OF THE DISINTEGRATION OF SHORT-PERIOD COMETS.**

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The imaging capabilities of the *Spitzer Space Telescope* [1] enable observations at unprecedented sensitivity of the extended distribution of debris around comets. Debris trails were serendipitously discovered along the orbits of 8 periodic comets using IRAS [2]. We have now imaged 31 periodic comets over fields of view large enough to clearly separate mm-sized debris from smaller grains produced in the present perihelion. Of these, 21 comets were found to a narrow trail of infrared emission closely following the projected path of the comet's orbit. An additional 7 may have trails but were exceptionally active and have not yet been separated from their small-grain tails. Three comets did not have (detectable) debris trails.

Two examples are shown in the Figure: 48P/Johnson (*top*) and 129P/Shoemaker-Levy 3 (*bottom*). The large fan-shaped coma of 48P is due to small particles ( $1 > \beta > 0.01$ ) from the present perihelion. The excellent viewing geometry (the Sun is to the lower right, and the comet's orbital motion is to the left) allows for clear segregation of particles by size. The situation is similar to that for the only high-quality large-scale image that had been previously made, 2P/Encke with the *Infrared Space Observatory* [3]. The debris trail can be seen both leading (toward lower-left) and trailing (toward upper-right) the nucleus. 138P was seen at greater heliocentric distance so its small-particle production is lower; the debris trail is distinct, both leading and trailing the nucleus.

In this talk, we discuss the systematics of cometary debris trails based on the infrared imaging survey, including dynamical simulations, and spectrophotometry (3.6-24  $\mu\text{m}$ ), and infrared spectroscopy (5-38  $\mu\text{m}$ ) for some of the survey comets.

**References:** [1] Werner, M. W. (2004), *ApJS* 154, 1. [2] Sykes, M. W., and Walker, R. G. (1992) *Icarus*, 95, 180. [3] Reach, W. T., Sykes, M. V. Lien, D., and Davies, J. K. (2000) *Icarus*, 148, 80

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