Six Comets in the Infrared : Clues to the Formation and Evolution of the Solar System. C. M. Lisse[1], M. L. Sitko[2], W.T. Reach[3], N. Dello Russo[1], and Y.R. Fernandez[4], [1]Johns Hopkins University Applied Physics Laboratory, [2]Space Science Institute, [3]IPAC/Caltech, [4]University of Central Florida.

Introduction: With the Spitzer Space Telescope (SST) and Infrared Space Observatory (ISO) we are beginning to understand the details of how the composition and formation of our own Solar System compares to those of other stars in our Galaxy. Recent, detailed observations of comets (remnants of the Solar System's proto-stellar nebula), protoplanetary disks around young stellar objects (YSOs), and debris disks around moderate-age stars have given us a collection of detailed spectra containing clues about our Galactic context. Here we discuss 5 to 35 micron spectroscopy of the emission from dust grains and gas molecules in the comae of 6 recent comets: C/ Hale-Bopp C/1995 O1 [1], 29P/SW1 [2], 9P/Tempel 1 (*Deep Impact* ejecta) [3], 73P/SW3-C [4], C/McNaught C/2006 P1 [5], and 17P/Holmes (in outburst) [6].

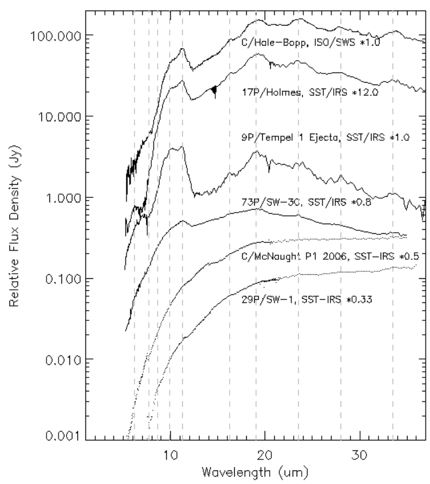

Figure 1 – ISO and Spitzer spectra of 6 recent comets.

Spectral Comparison. We find that the most highly detailed spectrum is that of the ejecta created by the Deep Impact encounter with comet 9P/Tempel 1 (Figs. 1 and 2), although the comet's spectrum was almost featureless before encounter,. The Hale-Bopp spectrum is also highly detailed, and the new Holmes spectrum is amazingly similar to it. The SW3 spectrum has much more detail than expected for an old ecliptic comet, while the McNaught spectrum is surprisingly featureless for such a active Oort-Cloud comet, similar to the relatively smooth spectrum seen for comet SW1.

Compostion. Using the results from the recent Deep Impact and STARDUST space missions, we can now constrain the relative abundances of the common spectral features we find due to silicates, carbonates, water ice, amorphous carbon, sulfides, and polycyclic aromatic hydrocarbons (PAHs) (Fig. 3). We discuss the similarities and differences in the spectra, and their implications for our Solar System's origins.

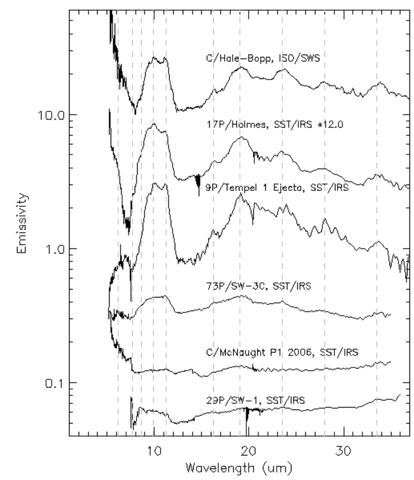

Figure 2 – Emissivity spectra for the comets, with coarse temperature effects removed and common emission features emphasized by normalization to the best-fit blackbody spectrum for each comet.

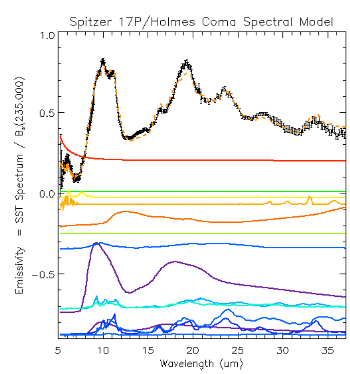

Figure 3 - Emissivity spectrum for 17P/Holmes 2007 on 17Nov2007, and best-fit model showing the individual components that create the observed emission. The comet was 2.4 AU from the Sun at the time of observation. Error bars are ±2σ.

References: [1] Crovisier, J. *et al.* 1997. *Science* **275**, 1904 [2] Stansberry, J.A. *et al.* 2004, *ApJ Suppl.* **154**, 463 [3] Lisse, C.M. *et al.* 2006. *Science* **313**, 635 [4] Sitko *et al.* 2006 DPS Abstract [5] Lisse, C.M. *et al.* 2007, IAUC 8862 [6] Reach, W.T. *et al.* ??

Acknowledgements: This work is based on observations made with the Spitzer Space Telescope, which is operated by JPL/Caltech, under a contract with NASA. Support for this work was provided in part by NASA through an award issued by JPL/Caltech.