ASTEROIDS AND CENTAURS: SILICATE EMISSION IN THE THERMAL INFRARED. J. P. Emery[1], L. F. Lim[2], F. Marchis[1], and D. P. Cruikshank[3], [1]Carl Sagan Center at SETI Institute (jemery@carlsagancenter.org), [2]NASA Goddard Spaceflight Center, [3]NASA Ames Research Center.

Introduction: The Spitzer Space Telescope has thrust open a door to mid-IR (5 to 38 μm) spectral studies of asteroids that had beforehand only been cracked by a few ground- and previous spaced-based efforts. Observations in this spectral range are challenging from the ground due to strong telluric absorptions and background emission. Nevertheless, spectral structure has been detected on a few asteroids in the 8 to 14-μm range from the ground [1,2], as well as from orbit with the ISO satellite [e.g., 3]. The Spitzer Space Telescope can observe asteroids with much higher sensitivity over a broader wavelength range than is possible from the ground or was possible with ISO.

Vis-NIR (~0.3 to 4.0 μm) spectroscopy has been successfully employed since the early 1970's to infer the surface compositions of asteroids. Thermal infrared (~5 to 40 μm) spectroscopy is similarly promising. Silicate spectra in this range are dominated by Si-O stretch and bend fundamentals, and other minerals have similarly diagnostic bands [e.g., 4,5].

Overview of Observing Programs: The Infrared Spectrograph (IRS) on Spitzer has observed more than 120 asteroids. Programs accepted but yet to be scheduled from Cycles 4 and 5 promise an additional few tens of asteroid observations. The asteroid sample includes objects from near-Earth space, through the Main Belt, and into the Jupiter Trojan swarms. Asteroids from all taxonomic classes have been observed, as have several binary and multiple component systems. The diameters of these targets range from a few hundred meters to a few hundred kilometers. On the whole, IRS has provided a broad sample of emissivity spectra of small Solar System bodies.

Thermal Flux Spectra: The measured thermal flux spectrum is important for constraining the asteroid's physical properties. The broad and continuous spectral coverage (including the peak in thermal emission) afforded by Spitzer/IRS enables robust modeling of the surface temperature distribution, which results in accurate estimates of the size, albedo, and thermal inertia (Fig. 1). Albedo is an important constraint for taxonomic type and composition. The size is a fundamental parameter that is particular revealing for binary and multiple systems – the density can be derived from known mass and size. Thermal inertia can be used to distinguish regolith cover from bare rock and metallic from non-metallic surfaces.

Emissivity Spectra: The mineralogy of the surface material is revealed in the emissivity spectrum, which is calculated by dividing the thermal flux spectrum by the modeled continuum. The largest emissivity features detected in the IRS data are at the 10% level and are confined to the more primitive asteroid classes (Fig. 2). These features have been attributed to fine-grained silicates [6]. Significant spectral variation is apparent among the IRS asteroid sample.

Discussion: We will present an overview of Spitzer observations of small bodies, highlighting a few science programs for more detailed discussion.

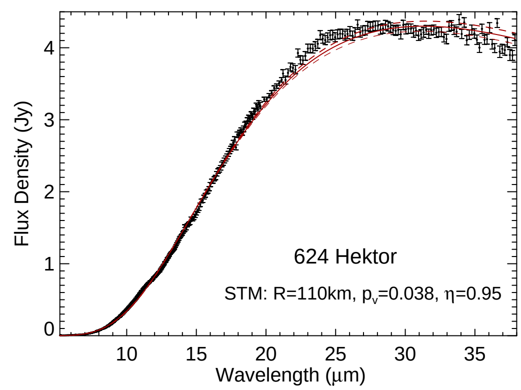

Figure 1. *Thermal flux spectrum of the Trojan asteroid 624 Hektor recorded on 2 Mar 2005 [6].*

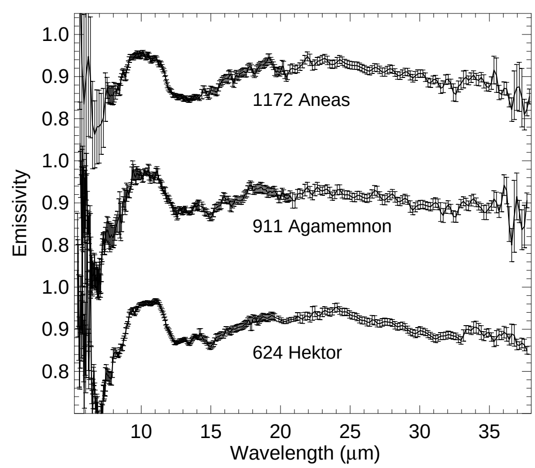

Figure 2. *Emissivity spectra of three Trojan asteroids measured by Spitzer/IRS in Mar and Aug 2005 [6].*

References: [1] Cohen, M. *et al.* (1998) *AJ 115,* 1671-1679. [2] Lim, L.F. *et al*. (2005) *Icarus 173*, 385. [3] Dotto, E., *et al.* (2002), *A&A 393*, 1065-1072. [4] Salisbury *et al.*. (1991) Infrared (2.1-25 μm) Spectra of Minerals. [5] Christensen. *et al.* (2000) *JGR. 105(E4)*, 9735-9739. [6] Emery, J.P. et al., (2006) *Icarus 182*, 496.