SURVEY OF BINARY ASTEROID SYSTEMS WITH SPITZER/IRS. F. Marchis[1,2,3], M. Baek[2], J.P. Emery[2], T. Michalowski[4], J. Pollock[5], J. Berthier[3], P. Descamps[3], B. Macomber[2], F. Velichko[5] [1]Carl Sagan Center at SETI Institute, CA Mountain View USA (fmarchis@seti.org), [2]Dept of Astronomy at UC-Berkeley, Berkeley CA, USA.[3]IMCCE-Obs de Paris, Paris, France. [4]Astronomical Obs., A. Mickiewics University, Poland [5]Appalachian State University, dept of Physics and Astronomy, Boone, NC, USA. [6]Kharkiv National University, Kharkiv, Ukraine

Introduction: To date, 160 asteroids are known to be binary or multiple systems. Insights, such as the size and shape of their components, the nature of their surface, their bulk density and distribution of materials in their interior, and the orbital parameters of their satellites; are the key to understanding how these multiple asteroidal systems formed.

Bulk density and surface characteristics: We obtained 19.9h of observations with Spitzer and IRS instrument to observe 26 known binary systems: 17 main-belt asteroids and 9 near-Earth asteroids. The recording of a low-resolution (R=100-600) thermal spectrum (5-42 μm) provided by this instrument is a powerful means of determining the asteroid size and albedo, as well as other physical properties, such as shape, spin state, thermal inertia, and surface roughness. Additionally, thermal emissivity spectra have strong silicate features (Si-O stretch and bend fundamentals at ~10 and 20~ μm), which can help to characterize the surface of asteroids [1] and infer the best meteorite analog for its composition [2].

Support from ground-based telescopes: To better characterize the orbital parameters of the binary systems and to be able to recover the geometry of the binary system at the time of Spitzer observations, we initiated a large campaign of observations with a worldwide network of observatories. Figure 1 shows the lightcurve recorded in Nov. 2007 of (1313) Berna, a binary synchronous system discovered by [3].

Preliminary results: This survey is currently being conducted and the spectra of 15 binary asteroids were successfully recorded. Figure 2 shows the low resolution processed thermal spectra (or SEDs) for (1313) Berna. The best-fit thermal model calculated with the STM leads to the measurement of its effective diameter, albedo of its surface, and color temperature related to the thermal inertia and surface roughness. The emissivity spectrum, created by dividing the measured SED by the best-fit STM, suggests that this asteroid is a S-type. Combining the radiometric diameter and the lightcurve, we derived a bulk density of ~1.7 g/cm^3, very close to the bulk density of (3749) Balam [4], another known multiple S-type asteroid.

References: [1] Emery, J. et al., (2006) Icarus, 182, 2. [2] Marchis et al., (2008), Icarus, in press [3] Behrend et al. (2004) IAU, 8292 [4] Marchis et al. (2008) Icarus, in press.

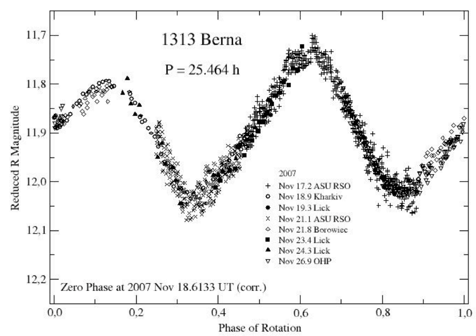

Figure 1: Composite lightcurve of (1313) Berna recorded from 5 different stations in Nov. 2007. The amplitude of the lightcurve (0.3 mag) suggests that the binary systems was seen in an almost face-on geometry.

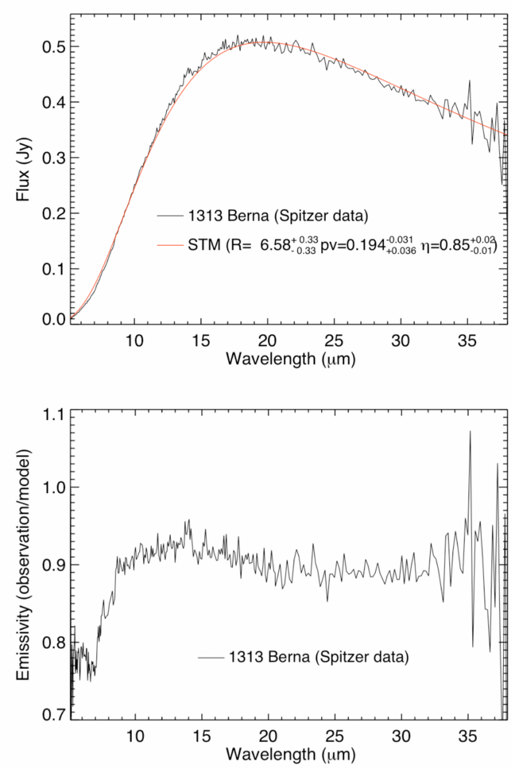

Figure 2: [top] Low resolution thermal spectrum (or SED) recorded on Oct 6 with Spitzer/IRS of the binary asteroid (1313) Berna and its best-fit STM.[bottom] Its emissivity spectrum created by dividing the measured SED by the best-fit STM. The emissivity spectrum is flat, with a drop-off at short wavelengths characteristic of an S-type asteroid.