The Space InfraRed Telescope Facility (SIRTF)

1 Science Objectives of the SIRTF Mission

Star forming regions: Regions of star formation are often embedded in dust and gas that is transparent in the IR; embedded protostars; T Tauri stars embedded in circumstellar disks; evaporative gaseous globules (EGGs); molecules (including organic molecules) in giant gas clouds.

Brown dwarfs: Objects with less mass than is needed to sustain core hydrogen burning; T dwarfs; L dwarfs; cloudy atmospheres with molecules like methane and ammonia; initial mass function at the low mass end; can brown dwarfs explain the missing baryons?

Planetary systems: Structure and composition of the giant gas planets; Kuiper and Oort Belt objects; zodaical light; comets; moons; dust and planets around other stars; circumstellar debris disks (e.g., β Pictoris).

Ultraluminous galaxies (ULGs): ULGs emit more energy in the IR than at all other wavelengths; starburst galaxies; colliding galaxies; activity near the "central engine" of quasars.

Early and distant universe: Observe the first stars and galaxies at high redshift.

2 SIRTF Instrument Description

2.1 Observatory

- Launched on 25 August 2003 into an Earth-trailing heliocentric orbit to minimize the heat load on the cryogen (360 liters of liquid helium).

- Estimated lifetime of 2.5 years (minimum) to 5+ years (goal).
- 85 cm diameter f/12 lightweight beryllium telescope cooled to < 5.5 K.
- Wavelength coverage 3–180 μm. Images are diffraction limited at $\lambda > 6.5\mu$m.
- Operated by the SIRTF Science Center on the campus of Caltech.
- 80% of the observing time is obtained by proposals. Next deadline for proposals is not yet announced. SIRTF Legacy Science Program will obtain observations of large and coherent samples of targets that will be in the public domain immediately and available for archival research.
- SIRTF is operating normally and should have a long life.
- Website: http://sirtf.caltech.edu/

2.2 InfraRed Array Camera (IRAC)

Central wavelengths: 3.6, 4.5, 5.8, 8.0 μm.

Array types: InSb or Si:As.

Field of view: 5x5 arcmin with 1.2 arcsec pixels.

Sensitivity: 5–34 μJy. (1 μJy = 10^{-29} erg/cm^2/s/Hz.)

2.3 Multiband Imaging Photometer for SIRTF (MIPS)

Central wavelengths: 24, 70, 50–95, 160 μm.

Array types: Si:As, Ge:Ga

Field of view: Various from 18.75x5 to 2.7x2.7 arcmin with 2.4 to 15 arcsec pixels.

Sensitivity: 240–7500 μJy.

2.4 InfraRed Spectrograph (IRS)

Wavelength range: 5–38 μm.

Array types: Si:As, Si:Sb

Spectral resolution: $\lambda/\Delta\lambda \leq 600$.

Field of view: Various from 4.8x12.1 to 55x58 arcsec with 1.8 to 4.8 arcsec pixels.

Sensitivity: 100–1500 μJy.

3 Some basic references:

- W. Benz, R. Kallenbach, & G.W. Lugmair (2000) "From dust to terrestrial planets", Space Sciences Reviews, Vol 92.
- C.E. Woodward, J.M. Shull, & H.A. Thronson Jr. (1998) "Origins", Astronomical Society Pacific, Conf. Series, Vol. 148.
- Ehrenfreund & S.B. Charnley (2000) "Organic molecules in the interstellar medium, comets, and meteorites: A voyage from dark clouds to the early Earth", ARAA, 38, 427.
- B. Zuckerman (2001) "Dusty circumstellar disks", ARAA, 39, 549.
- G. Basri (2000) "Observations of brown dwarfs", ARAA, 38, 485.
- Hauschildt et al. (1997) "Model atmospheres of very low mass stars and brown dwarfs", ARAA, 35, 137.