

NASA Infrared Telescope Facility
University of Hawaii, Institute for Astronomy
Honolulu, Hawaii 96822

This report covers the period from 1 July 2002 through 30 June 2003. The NASA Infrared Telescope Facility (IRTF) is a 3.0 m infrared telescope located at an altitude of 4.2 km on the summit of Mauna Kea in Hawaii. It was established by NASA in 1979 primarily to provide infrared observations in support of NASA's programs. The IRTF is managed and operated by the University of Hawaii (UH) Institute for Astronomy (IfA) under a five-year cooperative agreement between NASA and UH that started in February 2001. NASA provides the costs of operation, and NSF provides support for new focal plane instrumentation based on grant applications from IRTF support astronomers. Observing time is open to the entire astronomical community, and 50% of the IRTF observing time is reserved for studies of solar system objects.

1. PERSONNEL

Alan Tokunaga was the IRTF division chief during the period. Support astronomers were John Rayner, Shelte (Bobby) Bus, and Eric Tollestrup. Tollestrup joined the staff in June 2003 as the Deputy Division Chief, taking over this position from John Rayner. Rolf Kudritzki was PI of the IRTF cooperative agreement with NASA. George Koenig was superintendent of the telescope day crew, and Lars Bergknut was the foreman. Other members of the day crew were Imai Namahoe (electronics technician), Sammy Pung (mechanical technician), and Maury McOuat (observatory utility technician, as of October 30, 2002). Telescope operators were Bill Golisch, Dave Griep, and Paul Sears. Engineering/technical staff included Peter Onaka (senior electronics engineer), Fred Keske (electronics engineer), Doug Toomey (instrumentation engineer), Greg Ching (electronics technician), Darryl Watanabe (instrument technician), Dan O'Connor (engineering physicist), Tony Denault (senior software engineer), Charles Lockhart (embedded software engineer), Miranda Hawarden-Ogata (network engineer), James Pantaleo (systems programmer, as of May 1, 2003), and Tim Bond (senior mechanical engineer). Karan Hughes was the administrative assistant, Susan Lemn was the secretary, and Chris Kaukali and Sandra Miyata were the IRTF fiscal officers.

2. COMMITTEES

The NASA Management and Operations Working Group (MOWG) for the IRTF was chaired this year by Robert Millis (Lowell Obs.). This advisory group to NASA provides oversight of IRTF operations. Other members were Jacques Beckers (National Solar Obs.), William Cochran (McDonald Obs., Univ. of Texas), Heidi Hammel (Space Sci. Inst.), David Koerner (Univ. of Pennsylvania), Theodore Kostiuk (NASA GSFC), David Mozurkewich (NRL), Peter Schloerb (Univ. of Massachusetts), and Neville Woolf (Univ. of Ari-

zona). Ex-officio members were Vernon Pankonin (NSF), Tom Morgan (NASA), and J. Hillman (NASA).

William Cochran (McDonald Obs., Univ. of Texas), James Graham (UC Berkeley), Kevin Luhman (CfA), David Osip (MIT), Michal Simon (SUNY Stony Brook), and Faith Vilas (NASA JSC) served on the IRTF Time Allocation Committee. William Cochran was replaced by Nancy Chanover (New Mexico State Univ.) as of spring 2003. The TAC is chaired by IRTF Division Chief Alan Tokunaga, but he does not vote on proposals.

3. USAGE OF THE IRTF

Deadlines for observing proposals are 1 October for February–July and 1 April for August–January. The IRTF received 99 applications for observing time for the first semester of 2003, and 108 applications for observing time for the second semester of 2003. The average oversubscription factor was 2.9 for solar system programs and 2.2 for non-solar system programs for the second semester of 2003. The scheduled programs involve over 200 U.S. and foreign astronomers each semester. About 26% of the scheduled observing time was lost to bad weather and 1.2% to IRTF instrumentation and other facility problems.

4. THE TELESCOPE

The IRTF has an $f/38$ Cassegrain focus with two secondary mirror structures, one for tip-tilt and one for chopping. The Cassegrain instruments are mounted on the Multiple Instrument Mount, which allows for the simultaneous mounting of up to four instruments. Under normal circumstances, the IRTF facility instruments are kept mounted and ready for continuous use. Instrument changes can be accommodated in less than 30 minutes. This allows for short programs that require only a partial night.

4.1 Facility Instruments

The present complement of IRTF instruments covers the $\sim 1\text{--}25\ \mu\text{m}$ spectral range.

SpeX is a $0.8\text{--}5.5\ \mu\text{m}$ spectrograph with low to moderate resolving power (100–2500). It was commissioned in August 2000. The spectrograph section uses a 1024×1024 InSb array with $0''.15/\text{pixel}$. Five spectroscopic modes are supported. Slit widths from $0''.3$ to $3''.0$ are available. There is a slit viewer for infrared guiding and imaging capability. It uses a 512×512 InSb array at $0''.12/\text{pixel}$, with a $60''\times 60''$ field of view, and a 15-position filter wheel.

NSFCAM is a $1\text{--}5.5\ \mu\text{m}$ camera with a 256×256 InSb array. It has three selectable image scales of $0''.06$, $0''.15$, and $0''.30/\text{pixel}$, and 24 filters. A unique feature of NSFCAM is that it has circular variable filters (CVFs) that provide 1–2% spectral resolution from 1.5 to 5 μm . NSFCAM

also features a grism for long-slit spectroscopy. A warm waveplate rotator assembly allows linear polarization measurements to be obtained.

CSHELL is a high-resolution spectrograph that covers the 1–5.5 μm spectral range with 0".20 pixels. CSHELL uses a 256 x 256 InSb array. It has a 30" long slit and can also image a 30" x 30" area for easy object acquisition. Slits from 0".5 to 4".0 wide can be selected. The 0".5 slit provides a spectral resolution $R = 43,000$. An internal CCD is used for guiding.

MIRLIN is a 10–20 μm camera that is available as a facility instrument for up to four months per semester by arrangement with its developer, Mike Ressler (JPL). The camera utilizes a 128 x 128 Si:As BIB array. The pixel scale is 0".46/pixel. The user interface is similar to that of NSFCAM, CSHELL, and SpeX.

4.2 Visitor Instruments

The IRTF supports a number of visitor instruments and has encouraged the collaborative use of these instruments by advertising them on its Web site and in the semiannual announcement of observing time. A brief description of these instruments is given here:

TEXES is a high-resolution spectrograph for 5–25 μm . J. Lacy and M. Richter (Univ. of Texas) are the PIs on this instrument. It provides a resolving power of up to 100,000.

MIRSI is an 8–26 μm camera with gratings for the 10 and 20 μm atmospheric windows. L. Deutsch (Boston Univ.) is the PI.

BASS is a low-resolution spectrograph that can cover the entire 3–13.5 μm spectral range in a single exposure with $R = 25$ –120. It employs two 58-element BIB arrays. D. Lynch (Aerospace Corp.) is the PI.

CELESTE is a high-resolution 5–25 μm spectrograph that provides a resolving power of about 10,000. D. Jennings (GSFC) is the PI.

HIPWAC is a heterodyne spectrometer 9–12 μm with a spectral resolution greater than 1,000,000. T. Kostiuik (NASA Goddard) is the PI.

4.3 Facilities

Approximately two-thirds of the staff is located in the IfA-Hilo building, which is in the University of Hawaii's Hilo Research Park. The remaining staff is located in Honolulu. The IfA-Hilo building has laboratory spaces, a machine shop, remote observing facilities, and laboratory equipment. Instrumentation efforts are conducted in both Hilo and Honolulu.

4.4 New Instruments

A new adaptive optics (AO) relay was installed in May 2002. This is a 36-element curvature-sensing AO system that is similar to the University of Hawaii Hōkūpa'a AO system.

Engineering tests continued until June 2003. The AO system was returned to the Hilo laboratory for improvements at the end of June.

Since the AO system is installed above the instrument light path, the instrument spool and the acquisition guider have been also replaced. The acquisition guider has a second visible CCD channel that allows for visible photometry. The main objective of this CCD camera is to provide nearly simultaneous visible and thermal infrared photometry of asteroids.

4.5 Image Quality

To enhance image quality various improvements were made, including (1) replacement of a defective dome chiller, (2) improvements to the dome air conditioning system, (3) installation of hardware to remove heat from the focal plane electronics, and (4) sealing the gaps in the dome skirt and shutter areas to stop heat infiltration during the daytime. In addition, temperature sensors and a monitoring system were installed.

4.6 Remote Observing

The IRTF provides very flexible remote observing over the Internet. Remote observing from both the IRTF Hilo office and from the observer's home office began in August 2002, and currently about 30% of the observing nights involve some remote observing using our facility instruments. The typical remote observer controls the instrument from his or her office on the mainland with assistance from the telescope operator.

5. BUDGET

For the period 1 February 2003 to 31 January 2004, the IRTF has an operating budget of \$3.3 million, which includes support for the equivalent of 24 full-time positions, including the personnel devoted to fabrication and maintenance of instruments. Additional funds are secured from the NSF for instrument development. An NSF grant to upgrade NSFCAM with a 2048 x 2048 array has been awarded to the IRTF. As part of this upgrade, a single 40 milliarcsec per pixel scale will be provided, and a second wave-front sensor will be fabricated. A NASA grant to replace the obsolete telescope control system will fund a 24-month project beginning in August 2003.

6. WEB-BASED INFORMATION ACCESS

The IRTF Web site (<http://irtfweb.ifa.hawaii.edu/>) provides convenient access to IRTF information. Available information includes observing time application forms, instrument and telescope manuals, photometric catalogs, and the telescope schedule.

Alan Tokunaga