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The spitzer space telescope mission

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Abstract

The Spitzer Space Telescope, NASA's Great Observatory for infrared astronomy, was launched 2003 August 25 and is returning excellent scientific data from its Earth-trailing solar orbit. Spitzer combines the intrinsic sensitivity achievable with a cryogenic telescope in space with the great imaging and spectroscopic power of modern detector arrays to provide the user community with huge gains in capability for exploration of the cosmos in the infrared. The observatory systems are largely performing as expected, and the projected cryogenic lifetime is about five years. Spitzer is thus both a scientific and a technical precursor to the infrared astronomy missions of the future. This very brief paper refers interested readers to several sets of recent publications which describe both the scientific and the technical features of Spitzer in detail. Note that, until 2003 December, Spitzer was known as the Space Infrared Telescope Facility (SIRTF).

Keywords: Infrared; Space astronomy; Spitzer space telescope

1. Introduction to spitzer

The Spitzer Space Telescope, NASA's Great Observatory for infrared astronomy, was launched 2003 August 25 and is performing extremely well, returning excellent scientific data from its Earth-trailing solar orbit. Spitzer incorporates an 85 cm diameter telescope primary mirror, cooled to as low as 5.5 K, and three scientific instruments: IRAC and MIPS providing imaging at wavelengths from 3.6 to 160 μm and IRS providing spectroscopy from 5 to 38 μm. The observatory systems are largely performing as expected, and the projected cryogenic lifetime is about five years. The principal flight system contractors were Lockheed Martin for the spacecraft; Ball Aerospace for the telescope, the cryostat, the thermal control system, and two of the three instruments; and Goddard Space Flight Center for the third instrument. The operations systems were developed by JPL for Mission Operations and the Spitzer Science Center at Caltech for Science Operations. The ground systems and operations teams at JPL, Lockheed Martin Astronautics, and the Spitzer Science Center are routinely downloading 1.1 GB of data per day and delivering the pipeline-processed science data to the observer within 14 days.

After one year of observations it is clear that Spitzer will provide both greatly increased understanding of known astrophysical questions and discoveries that define new areas of scientific inquiry. At the same time, Spitzer demonstrates a number of observatory and mission design innovations which can be productively incorporated into future space programs. The most noteworthy of these is a warm launch architecture in which the telescope was launched warm and cooled down on orbit by a combination of radiative cooling and effluent helium vapor. This architecture is enabled by the Earth-trailing solar orbit which allows the back side of the telescope outer shell to be painted black so that it serves as a radiator while the solar panel on the opposite side is always pointed sunwards. The warm launch approach, unlike the cold launch used for ISO and IRAS in which the telescope was inside the cryostat at launch, decouples the size

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of the optics from the size of the cryostat and points the way towards larger cooled telescopes.

A series of 86 papers in the September 2004 issue of the *Astrophysical Journal Supplement Series* (volume 154, number 1) provide an overview of the Spitzer facility and instruments and initial scientific results on topics ranging from photometry of asteroids and comets to the distribution of galaxies in the distant, early Universe. A series of 22 papers in volume 5487 of the *Proceedings of SPIE – The International Society of Optical Engineering* – (entitled *Optical, Infrared and Millimeter Space Telescopes* and edited by John. C. Mather, published in October, 2004), go into much greater depth on technical issues and also describe Spitzer operations in detail. The readers of this paper are referred to these compendia for detailed information about Spitzer science, technology and operations. In addition, up to date details on the status and performance of Spitzer can be found on the Spitzer Science Center web site: spitzer.caltech.edu/SSC/. Information of interest to potential users of Spitzer can be found at http://ssc.spitzer.caltech.edu/documents/SOM/.

2. Conclusions

The Spitzer Space Telescope has been operating at high efficiency since 2003 December. Like its companion Great Observatories, Hubble and Chandra, Spitzer is an observatory for the entire scientific community. Thousands of hours of observing time on Spitzer will be available to the community annually through a peer-reviewed proposal process similar to that in place for Hubble and Chandra. Spitzer's five year cryogenic lifetime will permit several cycles of follow up observations to explore discoveries made early in the mission. Potential Spitzer proposers should watch for the release of the Call for Proposals annually around the first of November.

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