The IRAS 9P Photometry Collection

This data set description was prepared by Stephanie McLaughlin and is based on the documentation provided by Carey Lisse and included in this archive.

Data Set Overview

This data set contains 12-, 25-, 60-, and 100-micron photometry of the dust coma of comet 9P/Tempel 1 during its 1983 apparition. The photometry was derived from reconstructed observations acquired by the Focal Plane Array (FPA) instrument on the Infrared Astronomical Satellite (IRAS). The types of observations were Sky Survey Atlas (ISSA) scans and Additional/ Pointed Observations (AO). A comprehensive discussion of these data was provided by Carey Lisse and included as documentation. The reconstructed images used for this photometric analysis are available in the PDS data set DI/IRAS-C-FPA-5-9P-IMAGES-V1.0.

These data support the analysis of the dust environment of Tempel 1 for the NASA Deep Impact Mission (Lisse et al. 2005 [LISSEETAL2005]).

Background

IRAS imaged comet 9P/Tempel 1 during the months before and after perihelion on July 9, 1983. IRAS spent the majority of its observing time in the survey mode that systematically mapped the sky with a series of overlapping and confirming ISSA scans (Wheelock et al. 1994 [WHEELOCKETAL1994]). However, IRAS also devoted time to making pointed observations (A0) of selected fields of interest (Young et al. 1985 [YOUNGETAL1985]). IRAS observations were acquired by its Focal Plane Array, a multi-wavelength detector with spectral bands centered nominally at 12, 25, 60, and 100 microns (Beichman et al. 1988 [BEICHMANETAL1988]).

To support analysis of the dust coma of comet 9P/Tempel 1, Russell Walker selected sets of AO and ISSA images archived at the Infrared Processing and Analysis Center (IPAC), then corrected the images for the effects of extended source emissions. Walker delivered the reconstructed, in-band radiance images and noise maps to the Deep Impact project. These data are archived in PDS as data set DI/IRAS-C-FPA-5-9P-IMAGES-V1.0.

Walker provided aperture photometry of Tempel 1 with his delivery of reconstructed IRAS images. However, a preliminary review of the photometry determined that the background subtraction method could be improved. Lisse developed an algorithm that better simulated the background then used this method to derive the photometry in this data set.

Processing

The following reconstructed, in-band radiance images were used to derive the photometry:

AO

SOP	OBS	UTC Date	Bands (micron)
287	13	1983-06-18, 21.50 days pre-perihelion	12, 25, 60, 100
407	12	1983-08-17, 38.50 days post-perihelion	12, 25, 60, 100
407	43	1983-08-17, 38.75 days post-perihelion	12, 25, 60, 100
509	40	1983-10-07, 90.00 days post-perihelion	12, 25, 60, 100
510	22	1983-10-08, 90.25 days post-perihelion	12, 25, 60, 100

where SOP = satellite operations plan and OBS = observation number

ISSA

Mean SOP	Mean UTC Date	Bands (micron)
339	1983-07-14, 4.50 days post-perihelion	12, 25, 60, 100
368	1983-07-28, 19.25 days post-perihelion	12, 25, 60, 100
389	1983-08-08, 30.00 days post-perihelion	12, 25, 60, 100
421	1983-08-24, 46.00 days post-perihelion	12, 25, 60, 100
493	1983-09-28, 81.25 days post-perihelion	12, 25, 60, 100

where Mean SOP is the average satellite operations plan used to identify a specific, reconstructed survey scan

For sky background removal, Lisse applied an algorithm that employed a 2-dimensional quadratic surface fit to a synthetic background, created by taking the in-band radiance image and replacing all pixels within a certain pixel radius, centered at the nucleus, with the median value of the image. The masked region size was chosen to eliminate any contamination of the background by cometary emission. The background surface fit was then subtracted from the original in-band radiance image.

For photometry, circular apertures of increasing radii were sampled until the summed in-band radiances reached an asymptote. The results were recorded in ASCII tables, one for each in-band radiance image. For more information about these processes, refer the explanatory supplement included with this data set.

Parameters

The aperture photometry data are ASCII tables with fixed-length records. Each table contains five columns of data: aperture radius in pixels, aperture radius in arcseconds, total in-band radiance for the circular aperture, median value for the subtracted background, statistical noise in the summed in-band radiance. In-band radiance, background, and noise are recorded in units of Watts/cm^2/steradian.

The naming convention for the AO aperture photometry tables is sSOP_oOBS_BANDum_phot.tab where SOP is the satellite operations plan number, OBS is the observation number, and BAND is the wavelength in microns.

The naming convention for the ISSA aperture photometry tables is sMEANSOP_BANDum_phot.tab where MEANSOP is the average satellite operations plan number and BAND is the wavelength in microns.

Data

One photometry table corresponds to one reconstructed, in-band radiance image. The PDS label includes the file name of the radiance FITS image used to derive the photometry.

The first record in each photometry table is intentionally set to zeros because it is the true zero point for the photometry.

Media/Format

This data set is released as a logical data volume.

CONFIDENCE LEVEL NOTE

1) To derive calibrated absolute photometry using the in-band radiances found in the aperture photometry tables, convert the in-band radiance to a flux density, apply a color correction, then divide by a COBE/IRAS recalibration factor. These steps, along with correction and recalibration factors, are described in the explanatory supplement for this data set.

2) This data set was used extensively by the Deep Impact science team to develop a model of the dust coma of Tempel 1. These data were reviewed during an during an external peer review in October 2003 and were approved for ingestion into the PDS, pending the resolution of liens. Liens were resolved in August 2005.