Galactic Legacy Infrared Mid-Plane Survey Experiment (GLIMPSE)

Scientific Motivation

The inner workings of our own Galaxy are more mysterious than those of galaxies located millions of parsecs away, mainly because of our unfavorable location in the mid-plane outskirts of a dusty disk. The Milky Way is a typical luminous spiral of the types seen to large distances. Understanding its structure and the fundamental processes and interactions between gas and stars within it would benefit all galactic and extragalactic research programs. A Space Infrared Telescope Facility (SIRTF) Galactic Plane survey will provide a comprehensive view of the entire stellar and dust content inner Galaxy. The broad scope of these data will provide a global understanding that narrowly confined selected regions cannot, and they will provide vital information regarding two basic scientific questions:

- What is the structure of the inner Galaxy, including the disk, molecular ring, and bar, as traced by the spatial distribution of stars and IR-bright star forming regions (SFRs)?
- What are the statistics and physics of star formation? What are the properties of various stages of star formation, and how do they vary with location?

The first question involves the appearance of the inner Galaxy to an outside observer, vital for accurately comparing it to other galaxies. The second question involves the details of the star formation process by considering young, but heavily obscured, clusters which can be resolved spatially for the first time with SIRTF. Only the broad view of a survey can answer these global questions. In addition, there are many other interesting scientific problems that can be illuminated by the survey data.

Proposed Data Products

The Catalogs

Source catalogs are a fundamental tool to answer the scientific questions posed above. Consequently, the generation of such catalogs, for both point and extended sources, is one of our primary post-pipeline products and will be the initial focus of our analysis efforts.

We will produce a series of catalogs with the final products containing astrometric, photometric and morphological parameters for all sources detected above the 5σ level. The first product will be a Bright Source Catalog (BSC), with the limit set at approximately the 20σ level. The release of the first BSC is timed to be available for Guest Observer proposals, such as spectroscopic follow-ups. The GLIMPSE Source Catalog (GSC will be released in increments. Each release should reach the 5σ level, but will be restricted to a limited range in galactic longitude. Updated versions of released catalogs will occur periodically (about every 2 months) in order to incorporate any improvements in the subtraction of various background sources: zodiacal light, diffuse galactic background, extended red emission, galaxies, and solar system bodies. In addition, updates will incorporate the re-processing of the Basic Calibrated

Data products (by SIRTF Science Center – SSC) due to changes in SIRTF calibration pipeline.

Mosaicked Images

The ability to examine regions larger than an individual image can be crucial in addressing many science issues. The manner in which our survey will be produces images of adjacent fields which are likely to be rotated with respect to each other. The issue of geometric distortion must also be addressed. To aid in the analysis process, we will produce a series of mosaics at each observed wavelength that can be combined to generate images of a region of an arbitrary size and location.

GLIMPSE Database (GLIMPSEdb)

The database will be implemented in Oracle 8i probably residing on a Sun Microsystems Ultra 80 (2x450 MHz) computer. The core database schema will be implemented in the first 6 months of the program. The basic schema will likely consist of separate tables for each wavelength and post-pipeline processing level (i.e., Level A, Level B, etc.). Such a structure provides an efficient and natural way to import/export data, as well as to update and propagate changes in the state of the SIRTF and ancillary data. Refinements of the database structure will be modified and implemented in a modular way as the post-pipeline products and tools are developed. Revisions and modifications during Phase 1 will be executed on a separate ``development'' database. Changes to the database can be easily accomplished by using products like Rational Rose Enterprise Software coupled with Oracle's Enterprise Manager. All revisions will be implemented in a scheduled manner to avoid conflicts with other ongoing development tasks. Backups of the database will be executed on a regular time schedule in both cold (shutdown) and hot (in-service) modes, providing both long and short-term recovery of all transactions.

In addition to database transactions from incremental processing of the data (i.e., reprocessing of individual frames, source extraction), allowances in data entry must be made for the delivery of bulk data sets from. Such bulk data loads will be accomplished through a series of modularized scripts (implemented in Perl) that will include a wide selection of data integrity, validity, and constraint checking (e.g. Level A processing). Only the data that pass the initial integrity checks will be loaded into the database using the automated load processes.

Data Formats and Required Attributes

Image Types

FRAME: A single 256x256 image (plus metadata), associated with data obtained a specific time and a specific wavelength. A unique observation identification (FRAME_ID) will be assigned in Level A processing.

"Super-Mosaic": Sequence of FRAME-level data re-sampled onto a grid which represents the area targeted by the observational program: ~6 Gigapixels per mosaic

After **Level A** processing:

Unique Images associated with an individual frame (FRAME_ID)

Image Name	Bit-depth[1]	No. of Planes	Description
RAW	16	1	Raw image
BCD	32	2	Basic Calibrated Data
LATENT	16	1	Latency effect map
COSMIC_RAY	16	1	Cosmic ray map
BCD_MASK	16	1	Image artifact mask
INTERMED1	32	1	Intermediate stage of data in processing from RAW to BCD
INTERMED2	32	1	See INTERMED1
INTERMED3	32	1	See INTERMED1
INTERMED4	32	1	See INTERMED1
INTERMED5	32	1	See INTERMED1
INTERMED6	32	1	See INTERMED1
INTERMED7	32	1	See INTERMED1

[1]All images are 256x256xNunber_of_Planes unless otherwise noted.

Unique Attributes associated with an individual frame

Attribute Name[1]	Type	Description
FRAME_ID	VARCHAR	Unique identification for an observation made at a specific time and at a specific wavelength
Gdb_FRAME	INTEG*4	Internal Counter such that MAX(Gdb_FRAME) is the number of FRAME_ID in database.
FRAME_ATT_001	VARCHAR	Generic frame level attribute
FRAME_ATT_002	VARCHAR	Generic frame level attribute
FRAME_ATT_003	VARCHAR	Generic frame level attribute
FRAME_ATT_004	VARCHAR	Generic frame level attribute
FRAME_ATT_005	VARCHAR	Generic frame level attribute
FRAME_ATT_006	VARCHAR	Generic frame level attribute
FRAME_ATT_007	VARCHAR	Generic frame level attribute
FRAME_ATT_008	VARCHAR	Generic frame level attribute
FRAME_ATT_009	VARCHAR	Generic frame level attribute
FRAME_ATT_010	VARCHAR	Generic frame level attribute

[1]Generic attribute names will be replaced once specific definitions are available. It is anticipated that ~50 Attributes will be populated from Level A data.

Calibration images are associated with FRAME_ID, but many frames will share the same files. Calibration data should be a separate GLIMPSEdb table

Calibration Images used to Produce BCD from RAW:

Image Name[1]	Bit-depth[2]	No. of Planes	Description
FLAT_ID	32	2	Flatfield calibration file
FLAT_ID_MASK	16	1	Mask file for FLAT_ID
DARK_ID	32	2	Dark current calibration file
DARK_ID_MASK	16	1	Mask file for DARK_ID
CAL1_ID	32	2	Generic calibration file
CAL1_ID_MASK	16	1	Mask file for CAL1_ID
CAL2_ID	32	2	Generic calibration file
CAL2_ID_MASK	16	1	Mask file for CAL2_ID
CAL3_ID	32	2	Generic calibration file
CAL3_ID_MASK	16	1	Mask file for CAL3_ID

[1]Calibration filenames will be unique, i.e., changes to a flatfield calibration file by SSC will result in a new filename.

[2]All images are 256x256xNunber_of_Planes unless otherwise noted.