Archival Science in the Warm-Mission Era

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Setting the Stage

- Our planning for the period after the cryogen runs out includes not only the planning to support Warm Mission operations, but also plans to support a strong Spitzer archival science program.
- We expect that approximately half of the funding to the community during the Warm Mission period will go to archival science support. In dollars, that would correspond to of order $10 million per year for for GO programs and about $8 million per year for archive plus theory (compared to of order $2 million per year now).
- Notionally, we are assuming that the GO time will include of order 1000 hours for "small" programs, and of order 6000 hours for "large" programs.

Questions from yesterday

- Why are we allocating so little time to small GO programs? (I suggest people raise this question later on today if they are still interested, since it is outside the topic of my talk)
- Why are we advocating so little money to GO's (a Spitzer constant of $1.5K/hr vs. $3K/hr now) and why are we allocating so much money to archival users? - This I will try to address.

Our Answers

- We believe it is reasonable to increase the funding allocated to archival users as the mission advances simply because there is more data in the archive as time goes on (or, put another way, the ratio of archived data to new data per year increases with time)
- The "Spitzer constant" as now defined is an average over all programs - but with less money per hour for larger programs and less complex programs. The warm mission programs will on average be very large and the IRAC InSb data are the least complex of Spitzer's data.
- Most of the new data will be from large/legacy programs, which by design are more amenable to archival research (and require it to optimally make use of the survey data).

Your Answers?

- We have asked you here for your advice - so if you think a different allocation of resources would be better, you should tell us…

Evolution of the Spitzer Archive (1)

- We are currently adding about 4.5 TB of data to the Spitzer archive each year
- By the end of the cryogenic mission, we expect a total Spitzer cryo-mission archive data volume of order 25 TB
- The instrument teams will continue to work to improve their calibrations and our data processing pipelines for the remainder of the cryo-mission.
- About one year after the end of cryogen, all of the cryo-mission data will be reprocessed to provide a homogenous, long-lasting archive. All of the relevant Spitzer documentation will also be updated.
- We expect that during the warm mission, we will be adding of order 3.5 TB of new data each year.
- At the end of the warm mission, there will be a final reprocessing of the IRAC warm mission data, and a final updating of all Spitzer documentation. After those steps, the "keys" to the Spitzer archive will be turned over to IRSA, who will provide the long-term curation of the Spitzer mission data.

Evolution of the Spitzer Archive (2)

- Primary access to Spitzer archival data is now done via the Leopard interface. Leopard provides access to data on an AOR level, including all BCD's, pBCD products, raw data and associated calibration data.
- Publicly available Spitzer data are also accessible now via IRSA services, in the same way IRSA serves data from 2MASS, IRAS, etc. The IRSA access is position-based, and returns data on a BCD level - without, for example, providing the associated calibration files. The IRSA interface to Spitzer data will continue through the end of the warm mission.
- Prior to the final reprocessed data from the cryogenic mission becoming available, the SSC will inaugurate a new archive interface that will allow a wider range of options for querying the archive and selecting which data to download. This archive interface will also provide access to all available Spitzer documentation and user tools.
- After the end of the warm mission, the SSC archive interface and the archive itself will simply be turned over to IRSA - from a user perspective nothing will change except the email address of the helpdesk.

Types of Data Available from the Archive

- We currently distribute raw, BCD, post-BCD and calibration data via Leopard on a per-AOR basis.
- All of those data will also be available via the new interface for the Spitzer final archive, with the additional capability to access data on a per-BCD basis (for some purposes, this can be much better - e.g. if doing a query for all IRAC data for a large catalog of point sources).
- We also provide access to ancillary data obtained by Legacy teams - e.g. ground-based broad band imaging (as for SWIRE). We expect that at least some of the large warm-mission programs will collect extensive near-IR or optical imaging, and those data will be served by our archive.
- We also expect that we may provide some new types of enhanced data products in the final archive (e.g. IRS spectral cubes or source lists for imaging data) - those decisions are still TBD, however.
- The new interface will be VO compatible…

Types of Archival Proposals

- In recognition of the fact that the Spitzer archive is growing rapidly, and of the emphasis in the warm-mission period for very large GO programs, we intend to initiate a new class of archival research program for Cycle 6 - large or legacy archive programs. These archival research programs would be definition involve larger samples or more detailed analysis than "normal" archive programs. The large/legacy archive programs could have multi-year durations.
- There will be two broad categories of funded archival programs:
  - *Research programs - where the work and funding are to answer specific science questions;*
  - *Data enhancement - programs where the goal is to either reprocess existing Spitzer data to yield new products that are better than currently available, or to develop new data processing or analysis techniques that would also have as their goal the improvement of Spitzer data.*

SUMMARY

- A robust, user-friendly, well-funded archival program is an important adjunct to the Spitzer warm-mission.
- We believe we are taking the necessary steps to support such an archive.
- A white paper describing our plans for the archive and brief descriptions of some potential large archival projects is provided on the CDROM we have provided to you.
- We welcome any suggestions you have.

Sample Large Archival Proposals

- Survey all fields with >= 2 epochs of IRAC coverage for Y dwarfs (via their very red [3.6] - [4.5] colors and large proper motions)
- Galaxy number counts in 16 micron PeakUp images (from all IRS-SL spectral images where the peak up array is not saturated)
- Stacking analysis to determine average 70 micron fluxes for specific types of objects (e.g. Lyman break galaxies or QSO's detected at 24 microns to determine their SED's)
- Characterization of the size-frequency distribution for main-belt asteroids from fields with 2 epoch IRAC and/or MIPS imaging (separated by minutes to a few hours)
- Identification of various classes of red objects (protostars, WR stars, AGB stars) from their location in near-IR plus mid-IR color-color planes by combining 2MASS and IRAC imaging where available.