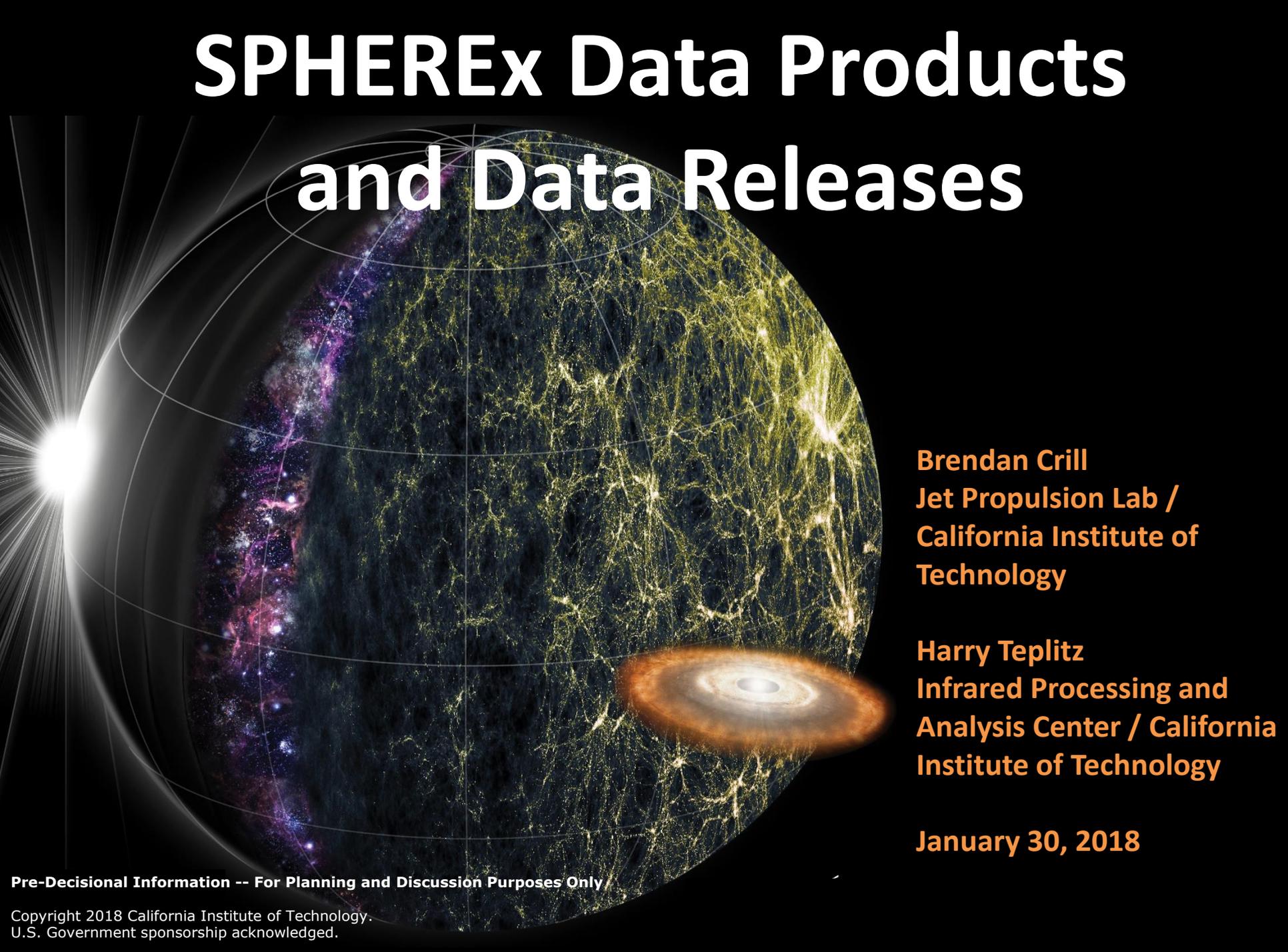


SPHEREx Data Products and Data Releases



Brendan Crill
Jet Propulsion Lab /
California Institute of
Technology

Harry Teplitz
Infrared Processing and
Analysis Center / California
Institute of Technology

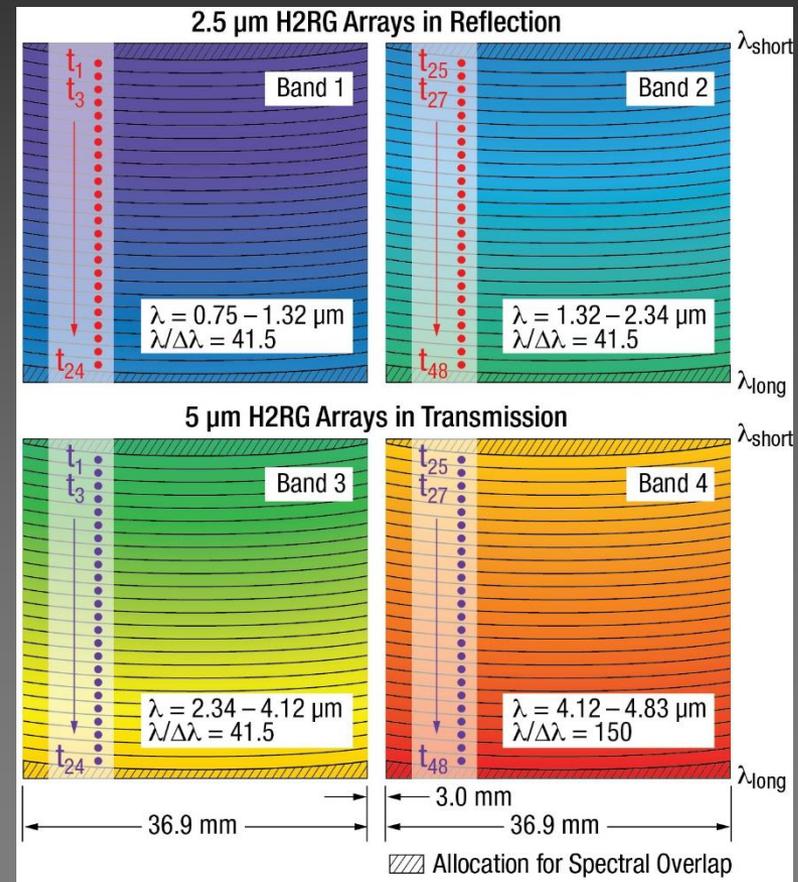
January 30, 2018

Pre-Decisional Information -- For Planning and Discussion Purposes Only

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U.S. Government sponsorship acknowledged.

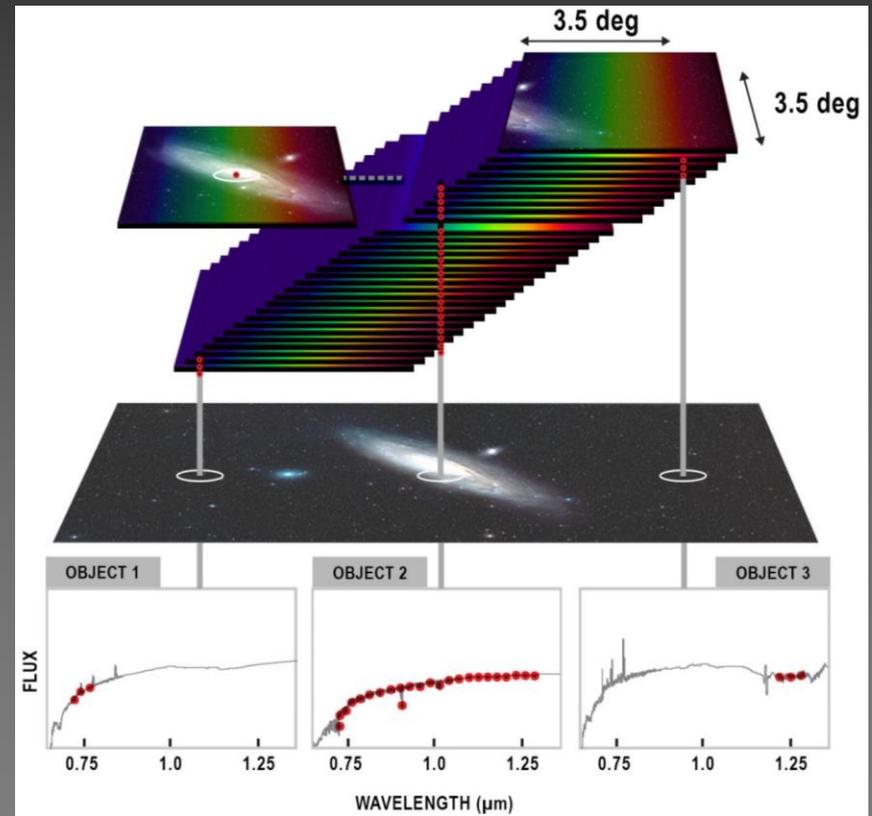
SPHEREx Native Data Format: Spectral Images

- Every telescope pointing and detector read would give four H2RG exposures, each behind a Linear Variable Filter
- After basic detrending in our pipeline, the exposure data consists of 4 .fits files, with bandpass varying across the image (encoded as an additional axis in the WCS header)
- We plan to release these as *Quick Release Data* in monthly releases
- 6-month data releases would include re-processing of entire previous 6-months of spectral images with latest calibration



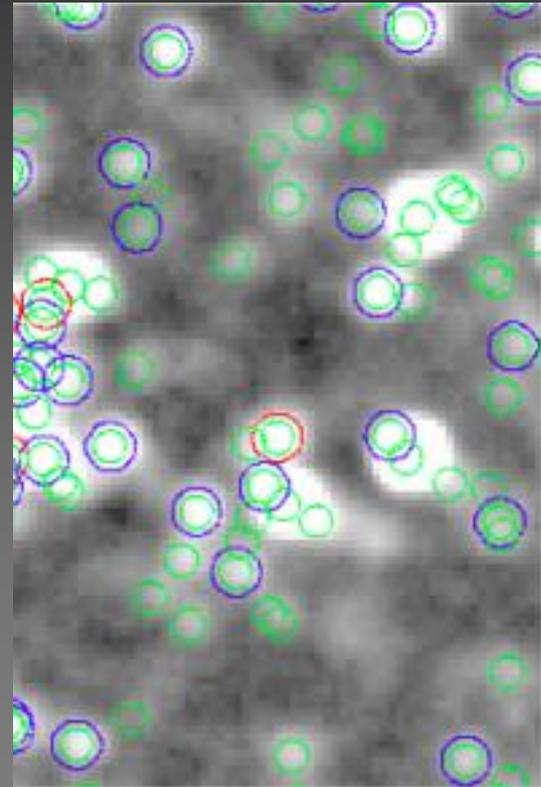
Data Cubes

- As SPHEREx scans the full sky, spectral coverage is built up
- Mosaicked *Data Cubes*, i.e. image maps at constant wavelength, would be reconstructed.
- 6-month data releases, following each full sky survey, would include data cube built from prior 6-months of spectral images
- Data Cubes in deep region (in broad bands) forms the basis of the Galaxy Formation science theme

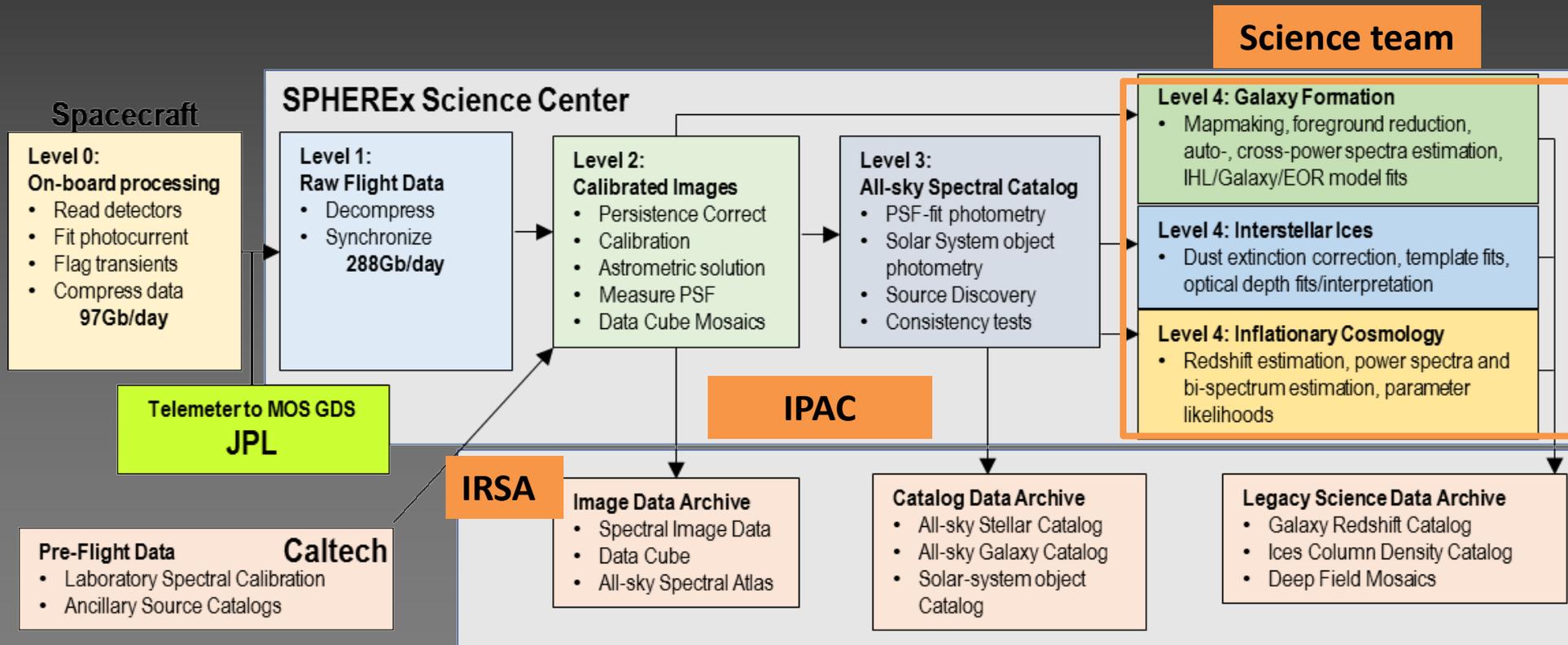


Catalog Data: Forced Photometry

- SPHEREx would create spectrophotometric catalogs by PSF-fitting spectral image data at known source positions
- Existing algorithms for performing the fit, i.e. TRACTOR, are under investigation
- These catalogs form the basis for the Inflationary Cosmology and Ices science themes
- A *High Reliability Catalog* would be released after 1 year (after a consistency check)
- Final Galaxy and Stellar Catalogs to be released in final data release
- Note: Relies on good PSF reconstruction



Planned SPHEREx Science Pipeline



SPHEREx Data Products & Tools

Planned Data Releases

Survey Data	Date (Launch +)	Associated Products
Quick Release Data	monthly	Previous month spectral images
Survey 1	1 – 8 mo	S1 spectral images/data cube
Survey 2	8 – 14 mo	S1/2 spectral images/data cube Early release catalog
Survey 3	14 – 20 mo	S1/2/3 spectral images/data cube
Survey 4	20 – 26 mo	S1/2/3/4 spectral images/data cube
Final Release		Legacy catalogs and maps

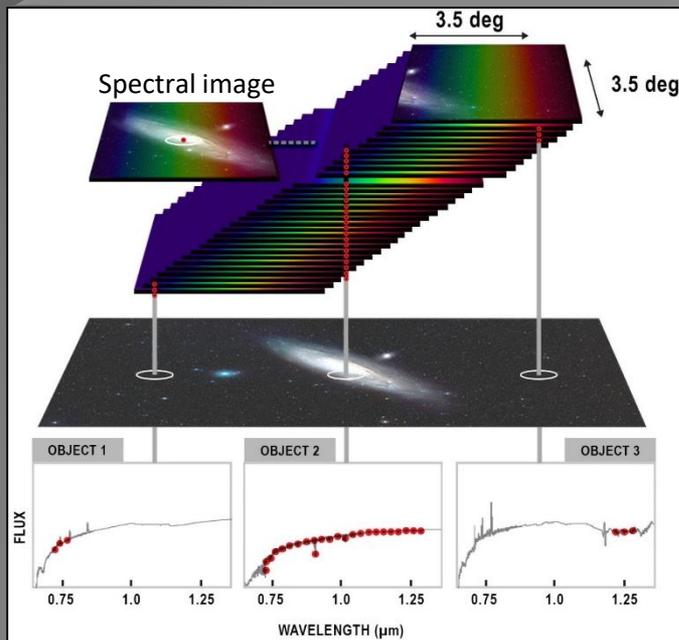
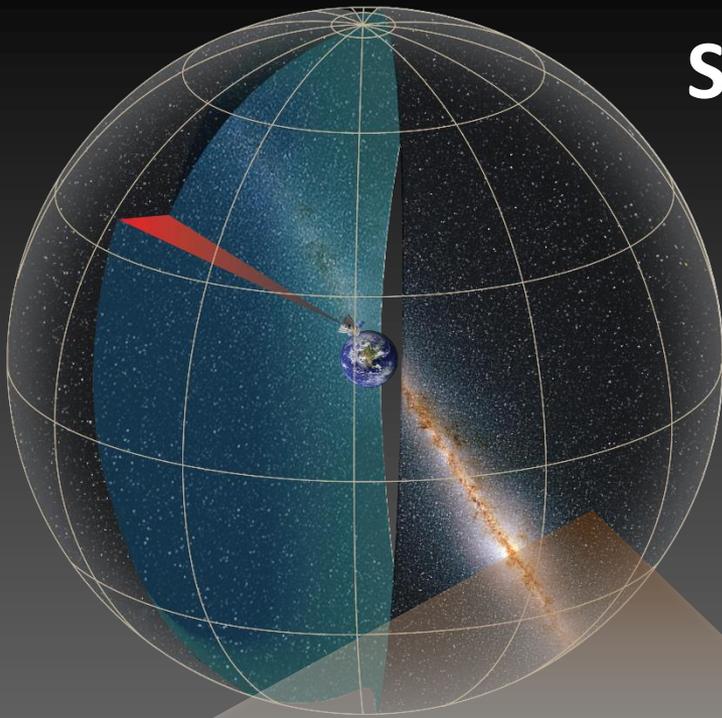
Available Data Tools: Served through IRSA at IPAC

Analysis Tool	Function
Image lookup	Find image at location and time
SED estimator	Find spectrum of a known source
Data cube viewer	View spectrum of any sky region
On-the-fly mosaics	Images within specified time
Variable sources	Spectra over all 4 surveys
Moving sources	SEDs for known moving objects

Legacy Catalogs and Maps

Catalog	#	Function
Core science catalogs	> 450 M > 20,000	Galaxy types & redshift Ice sources
Deep field maps		Image mosaics
Stars	> 100 M	SEDs of known stars
Galaxies	1.4 B	SEDs of known galaxies
Clusters	25,000	SEDs of cluster members
Asteroids	10,000	SEDs of known objects
Galaxy maps		Image and line mosaics

more releases, tools and catalogs under consideration



SPHEREx at IRSA



NASA/IPAC INFRARED SCIENCE ARCHIVE

IRSA | DATA SETS | SEARCH | TOOLS | HELP

Login

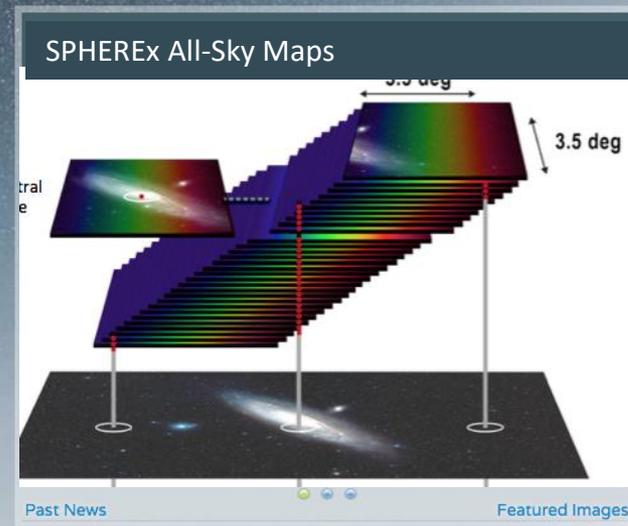
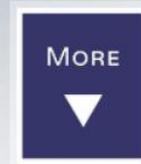
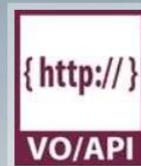
Search for Source

Name or Coordinates

Radius

[Guide for Solar System Observers](#)

Search Catalog:



Knowledgebase

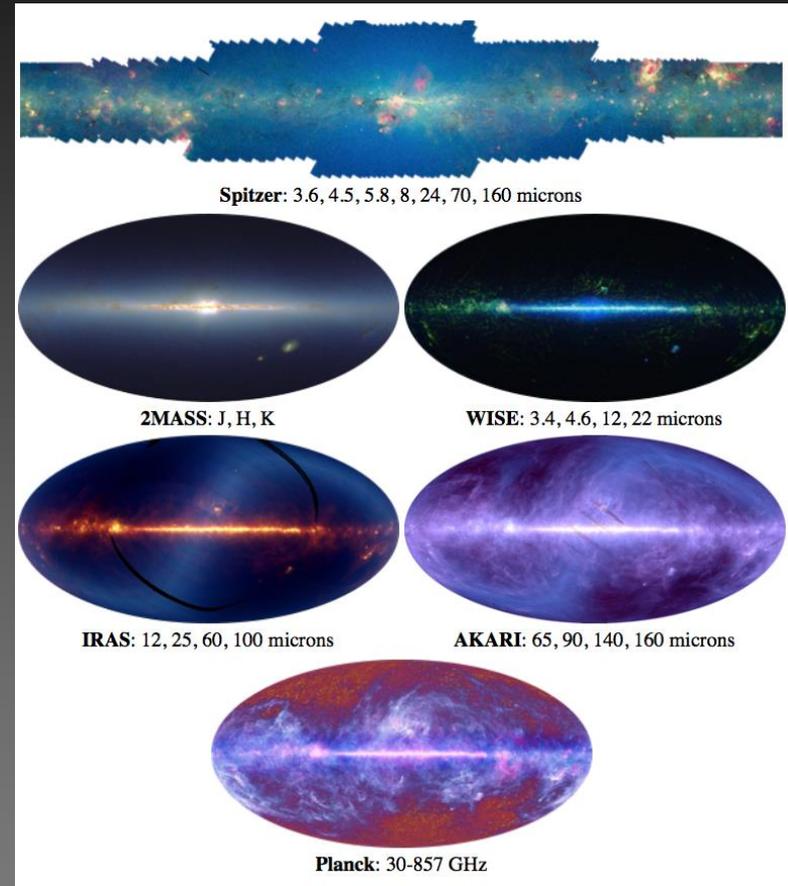
Documentation

Video Tutorials

Help Desk

IRSA : NASA's IR/sub-mm archive

- IRSA ensures the legacy of the “golden age” of IR
 - Enable research that has not yet been envisioned.
 - Priorities set by missions and the community
 - Support future flight missions
 - NASA and complementary data (AKARI, Gaia)
- IRSA is continuing rapid expansion
 - Since 2011, holdings more than doubled (now > 1 PB);
 - # table rows increased by factor of 15 (>100 billion)
 - Almost 40 million queries in 2016
- *About 40% of approved ADAP programs involve analysis of IR data sets served by IRSA*



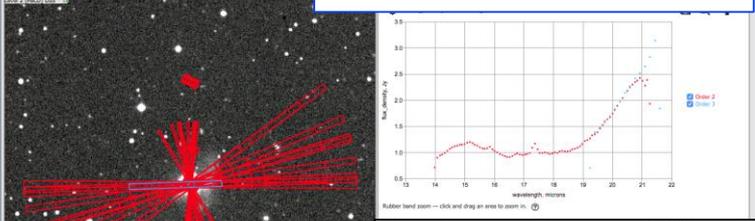
- *All-sky 24 photometric bands from 1 micron to 1 cm*



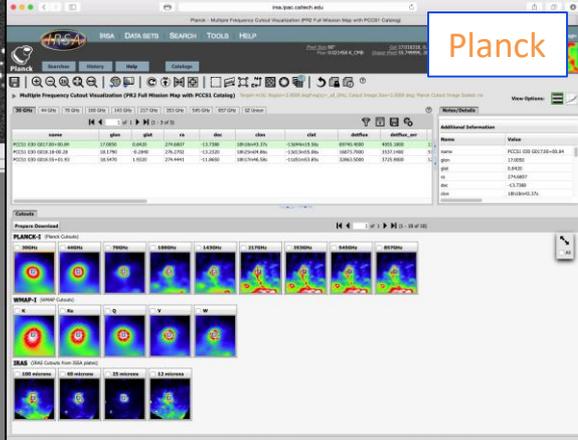
Data Exploration & Visualization

- Search & display can be tailored to various instrument/science contexts, using reusable visualization components
- Combine images, plots, tables, spectra
- Facilitates follow-up observation planning
- Firefly by IPAC

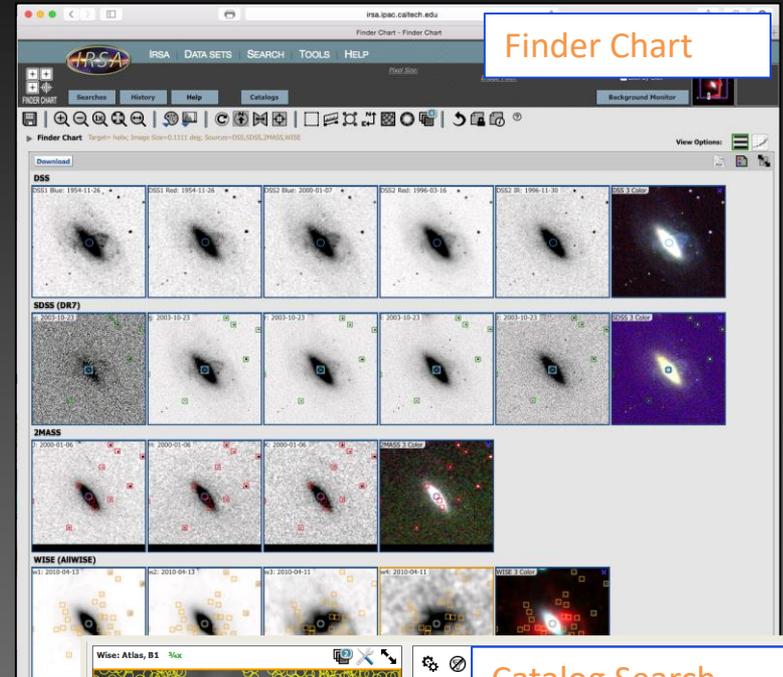
Spectra visualization



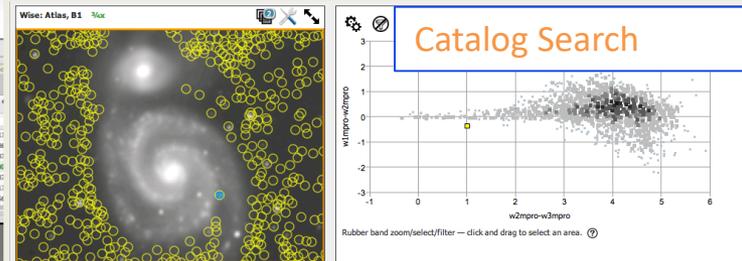
Planck



Finder Chart



Catalog Search



Result IPAC Table

Column Key

	l	b	name	value
560	0.037	25.1	1.258e+00	15.349
412	0.037	25.2	1.240e+00	16.771
178	0.037	25.2	2.303e+00	15.194
447	0.037	25.2	1.105e+00	15.371
347	0.037	25.3	1.044e+00	15.116
522	0.037	25.4	9.519e-01	15.465
416	0.037	25.5	9.390e-01	15.144
402	0.037	25.5	1.262e+00	15.259
454	0.037	25.6	1.073e+00	15.569
948	0.037	25.6	2.545e+00	13.426
369	0.037	25.6	8.901e-01	15.020
495	0.037	25.6	1.003e+00	15.368
334	0.036	25.8	9.275e-01	14.975
313	0.036	25.8	1.919e+00	16.359
423	0.036	25.8	9.583e-01	15.428
389	0.036	25.8	1.068e+00	15.078
283	0.036	25.8	8.355e-01	15.230

SPHEREx at IRSA

- IRSA hosts IR all-sky surveys
- IRSA broadens the reach of individual missions by
 - Placing them in the multi-wavelength context
 - Offering Data Exploration & Visualization services (Firefly by IPAC)
 - Hosting data analysis tools (web-based and downloadable)
 - Enabling command-line access through the VO and other API
- Archive design and documentation
- User support
- Incorporate tools developed by the science team
- Visualization and Analysis Interfaces
 - Complex catalog queries (SQL)
 - Image search by position or mission parameters
 - Spectral data cube extractor and viewer
 - On the fly mosaicker
 - Forced position spectral flux density extractor
 - Variable source extractor
- Serve enhanced products from the science team