

Mid and Far Infrared Space Surveys – Spitzer, Herschel, WISE, and SPICA

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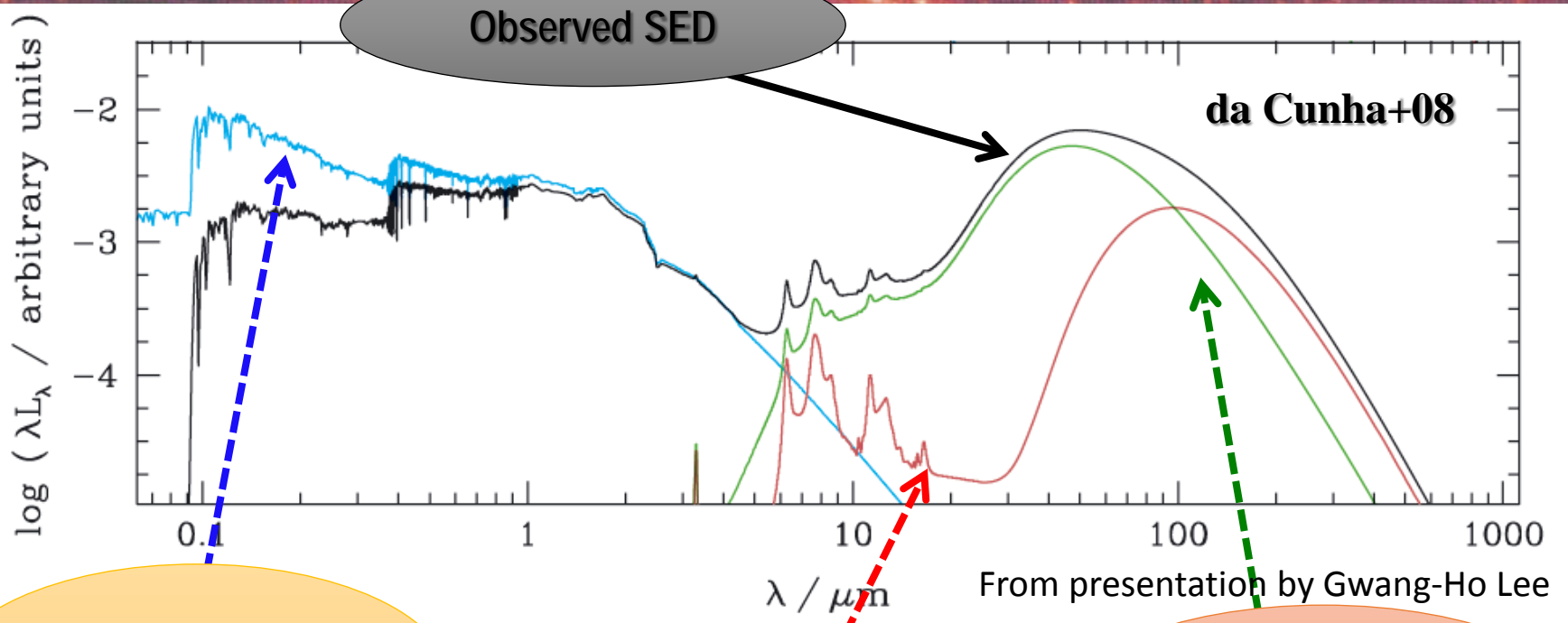
Survey Science Group Workshop



Outline

- Why Mid / Far infrared?
- IR space telescopes
 - History
 - Instruments
- IR space surveys
 - KINGFISH
 - SINGS
 - GOODS-Herschel Survey
 - WISE

Why Mid / Far Infrared?



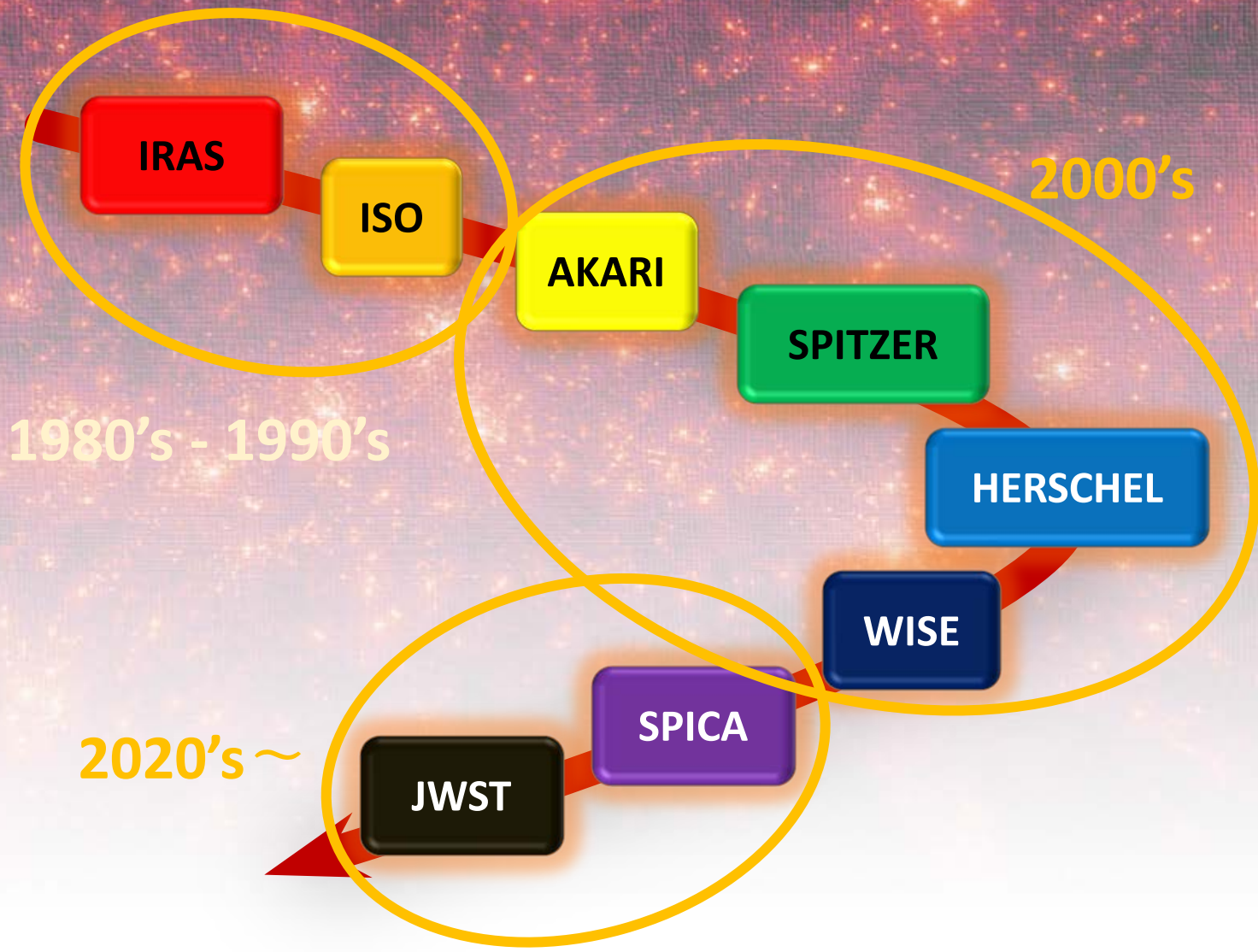
Unattenuated stellar spectrum

Emission by dust in stellar birth cloud

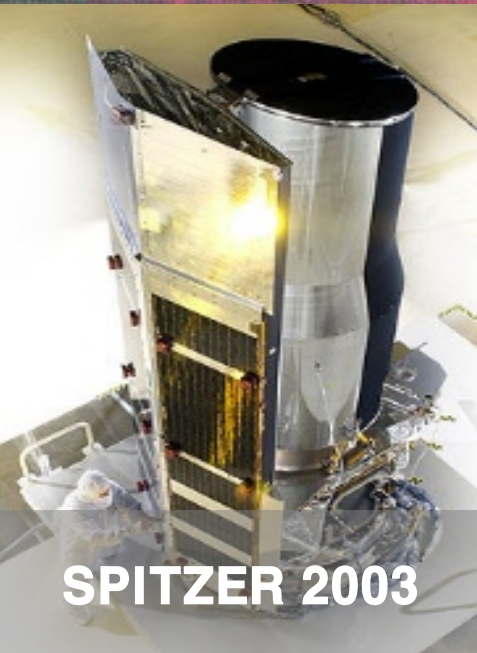
Emission by dust in the ambient ISM

- NIR/MIR spectral features move to MIR/FIR in high redshift

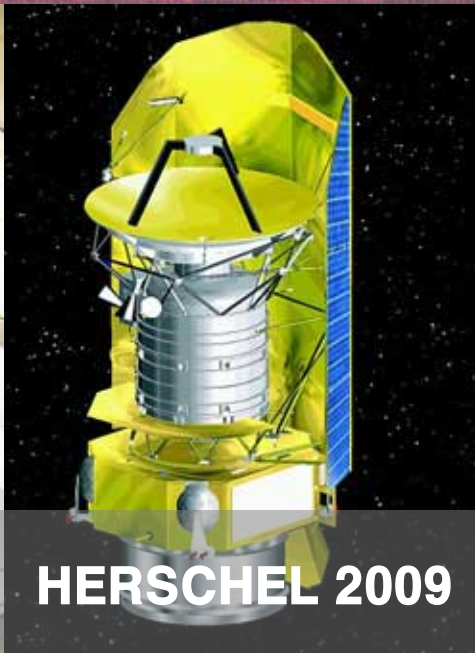
History of IR Space Satellite Missions



IR Space Telescopes



SPITZER 2003



HERSCHEL 2009



WISE 2009



SPICA 2022

- Relatively recent / near future telescopes
- Many sciences (surveys) has been done with above telescopes

IR Instruments

Telescope	Instrument	Wavelength	Resolution	Type
SPITZER	IRAC	3.5, 4.5, 5.8, 8 μ m	1.22", R~1000-5000	IM, SP
	IRS	5.2-38 μ m	R~3-600	SP
	MIPS	24, 70, 160 μ m	6", 18", 40", R~15-25	IM, SP
HERSCHEL	PACS	55-210 μ m	3.2", 6.4", R~1000-5000	IM, SP
	SPIRE	194-672 μ m	R~40-1000	IM, SP
	HIFI	157-625 μ m	R~10 ⁷	SP
WISE		3.4, 4.6, 12, 22 μ m	6.1"-12"	IM
SPICA	SAFARI	34-210 μ m	R~50-2000	SP
	MCS	5-38 μ m	R~1100-30000	SP
	FPC	0.7-5.2 μ m	0.3"	IM
	SCI	4-28 μ m	R~200	IM, SP

IM = Imager, SP= Spectrograph

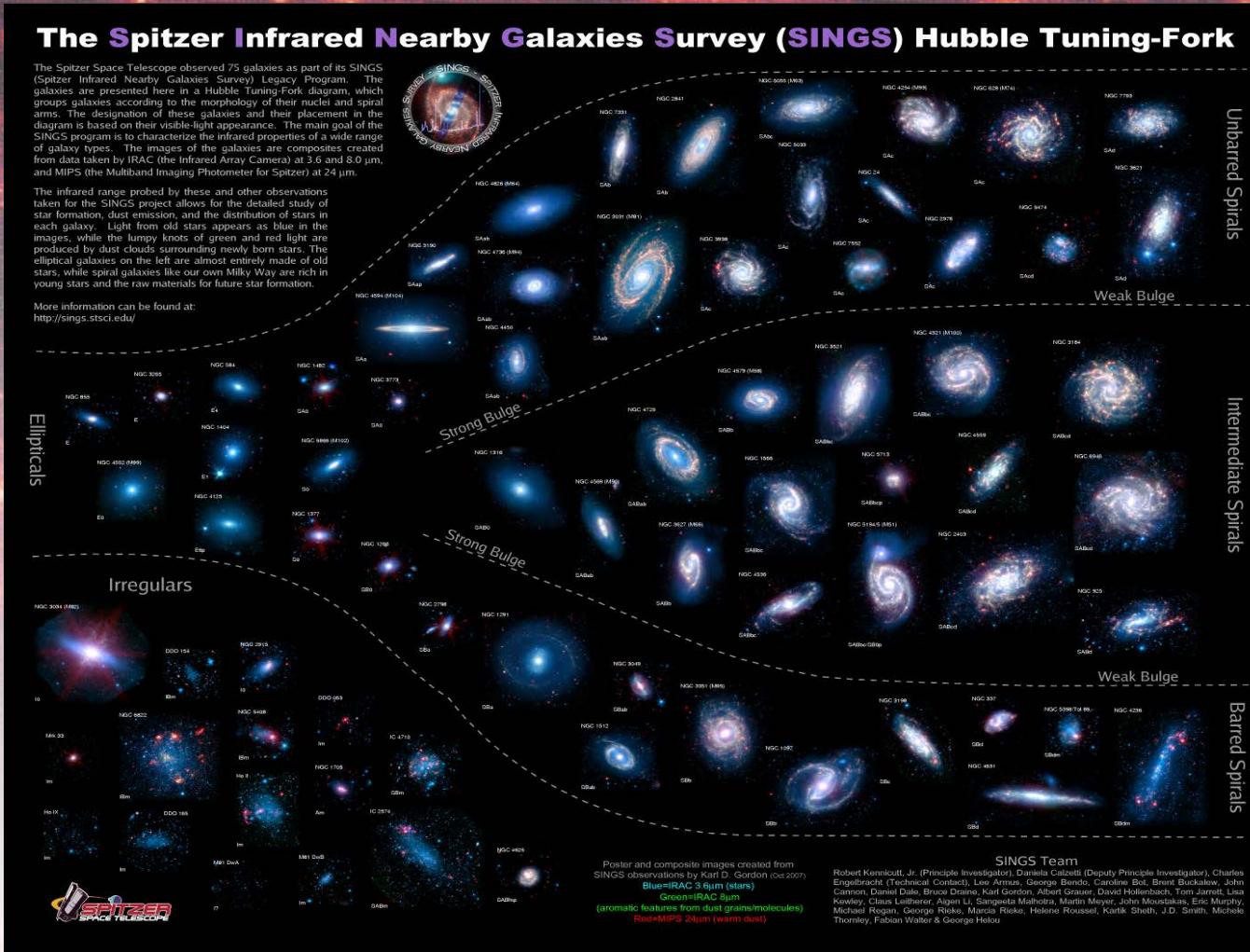
List of Surveys

- Spitzer
 - GOODS, SWIRE, S-COSMOS, **SINGS**, SIMPLE, SAGE, GOALS, FIDEL, SSGSS, SpUDS, SAGE-Spec, LVL, SAGE-SMC, 5MUSES, SDWFS, S5, COSMOS-IRS, MAGES, EGAMI, GLIMPSE I/II/3D, MIPSGAL I/II, c2d, GouldsBelt, FEPS, Taurus-2, Cygnus-X, SMOG, ExoplanetToO
- Herschel
 - HerMES, Herschel-ATLAS, CACHE, Herschel Lensing Survey, **KINGFISH**, HeRS, PEP, VNGS, SHINING, HELGA, HerM33ES, LoCuSS, HeViCS, HerCULES, NHEMESES, Herschel-GOALS, HEDGES

<http://herschel.cf.ac.uk/mission/key-programmes/galaxies>

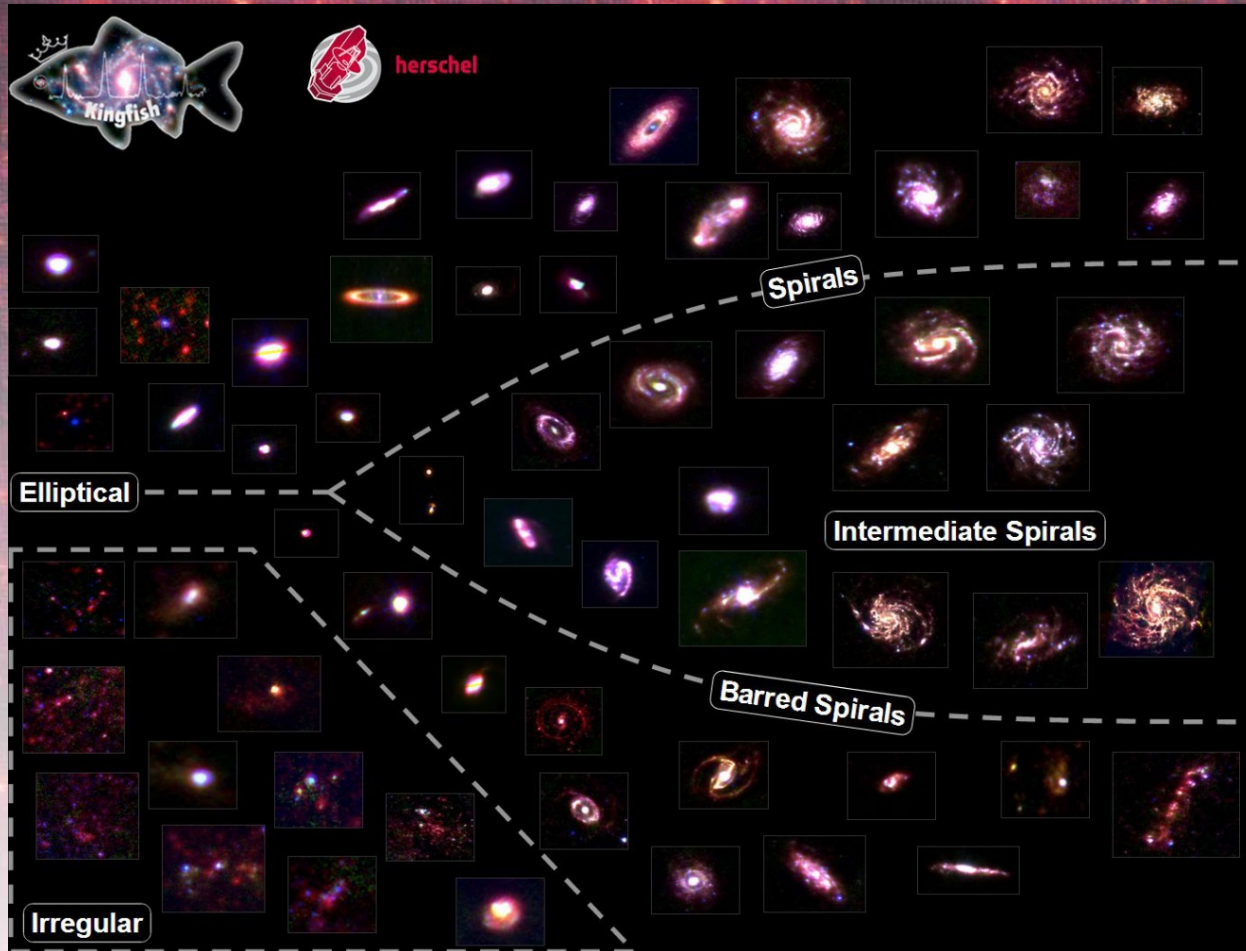
<http://irsa.ipac.caltech.edu/data/SPITZER/docs/spitzermission/observingprograms/legacy/>

SINGS - Spitzer



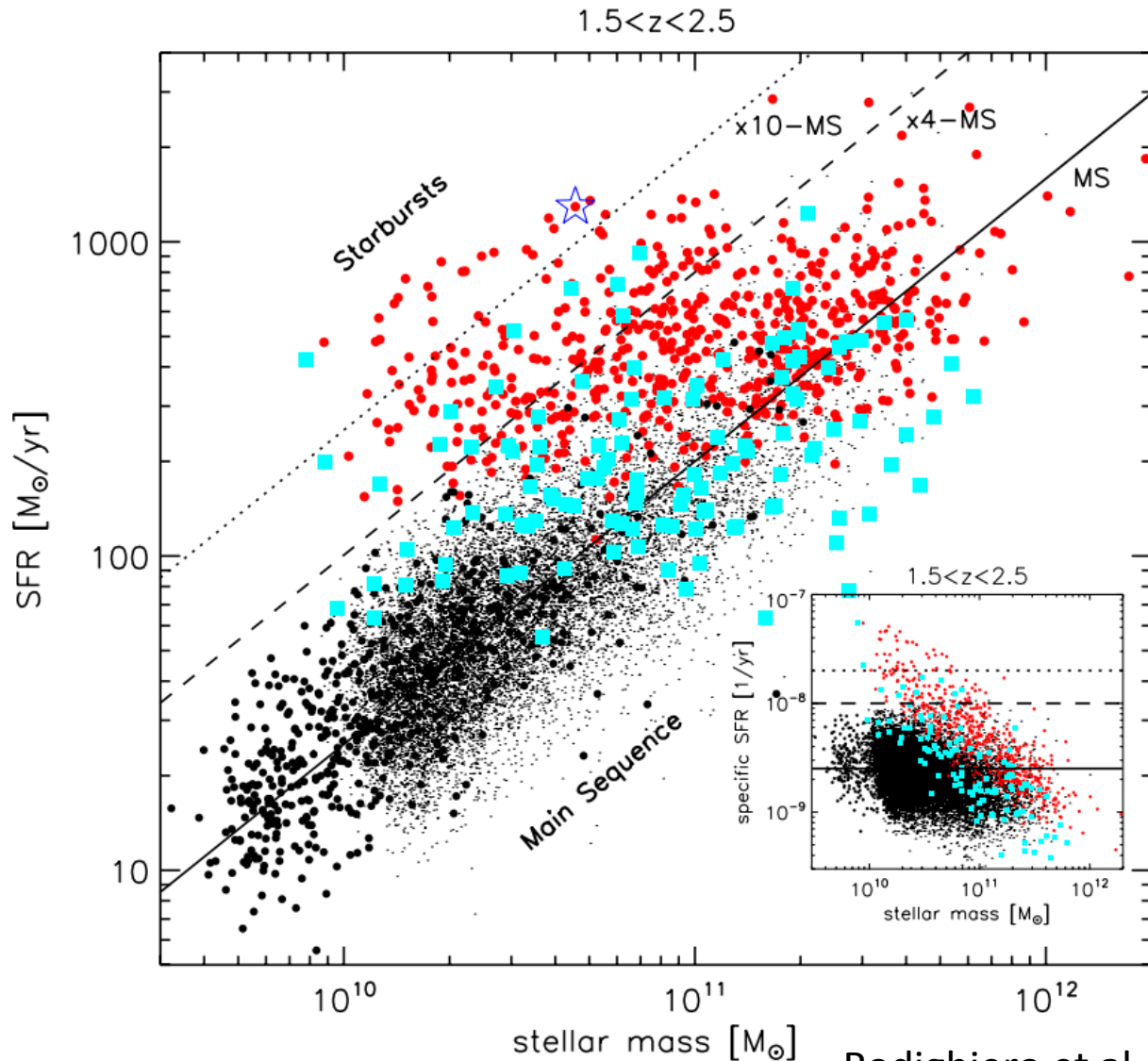
- Imaging and spectroscopic survey of 75 nearby galaxies (d < 30 Mpc)

KINGFISH - Herschel



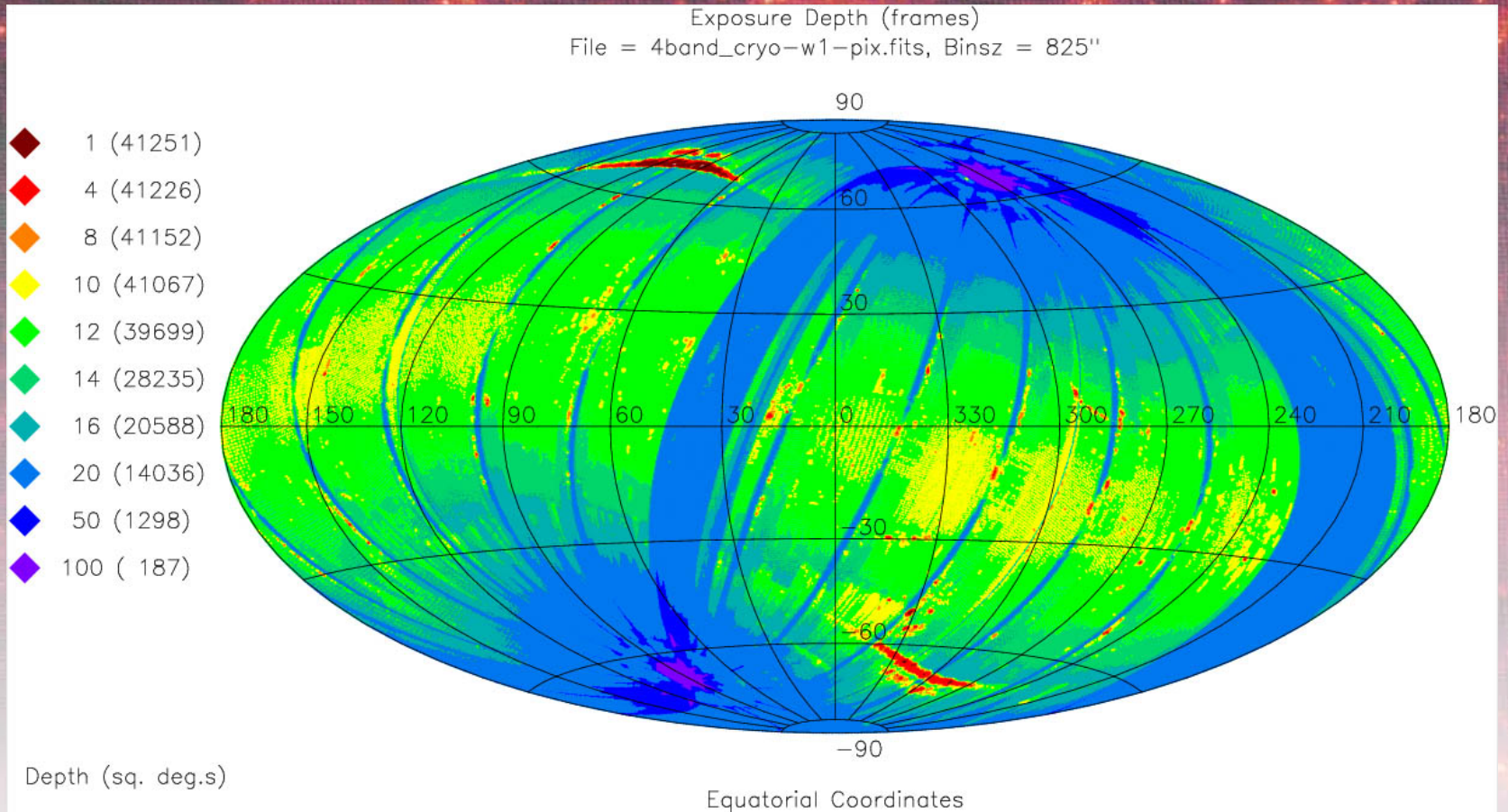
- Imaging and spectroscopic survey of 61 nearby galaxies ($d < 30$ Mpc) including 57 galaxies from the SINGS projects
- KINGFISH is a direct descendent of the SINGS

GOODS-Herschel Survey



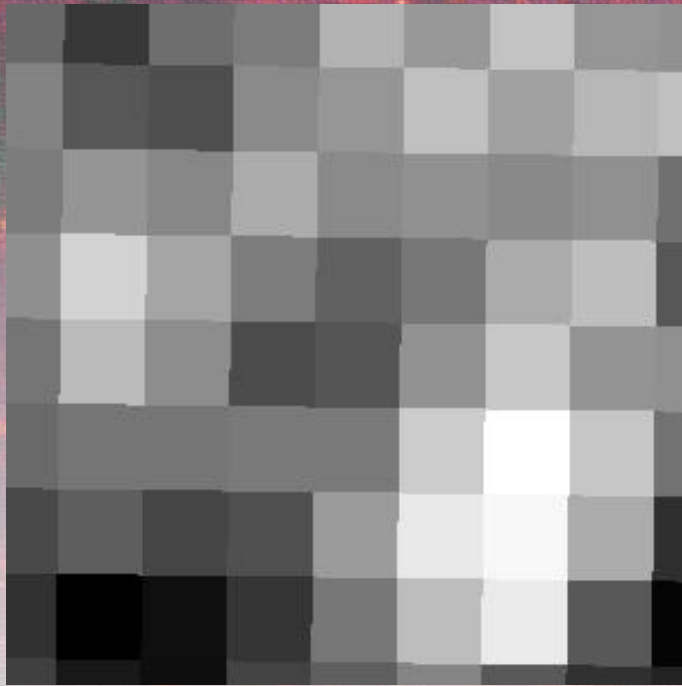
- MIR: Stellar mass
- FIR: Star formation

WISE

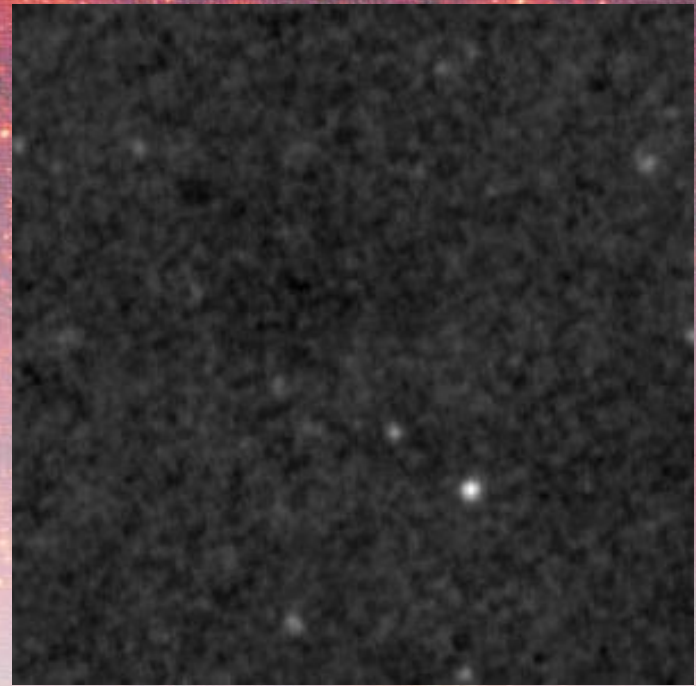


- All sky survey
- 3.4, 4.6, 12, 22 μ m, Spatial resolution: 6"
- High sensitivity : 1,000 times better than IRAS

WISE versus IRAS



IRAS (1983)



WISE (2009)

- Two images of the same region
(12 μ m, 0.2 x 0.2 degrees at RA=2h 40m, Dec=20 degree)

SPICA Overview

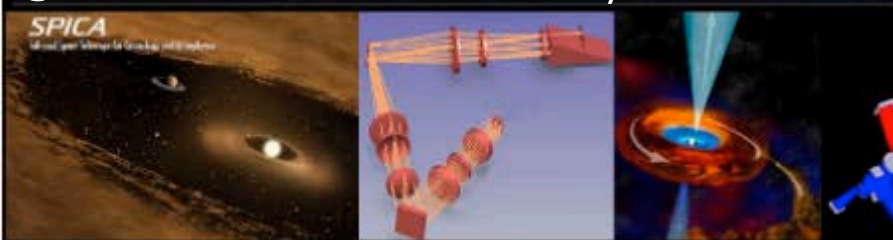
**3.5 m telescope
Cooled to < 6K**



Instruments cover 0.7-210 μ m

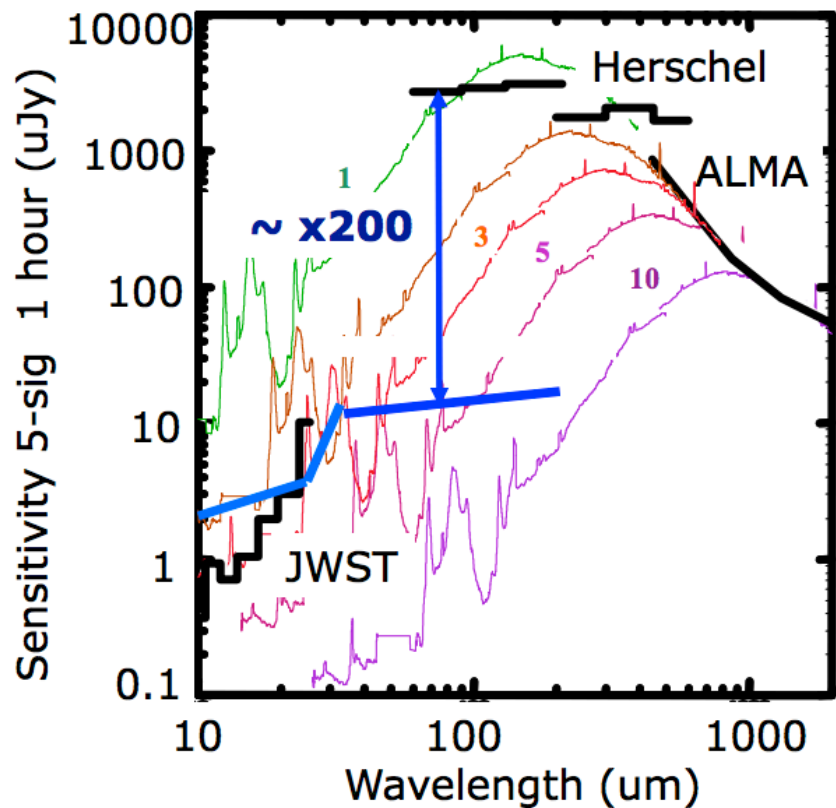
- MIR imaging spectro-photometer
- **FIR imaging spectrometer.**
- MIR Med/Hi Resolution Spec.
- MIR coronagraph
- Focal Plane Camera (guiding)
- LW spectrometer (optional)

From presentation by Bruce Swinyard
@SPICA Science Case - Community Presentation

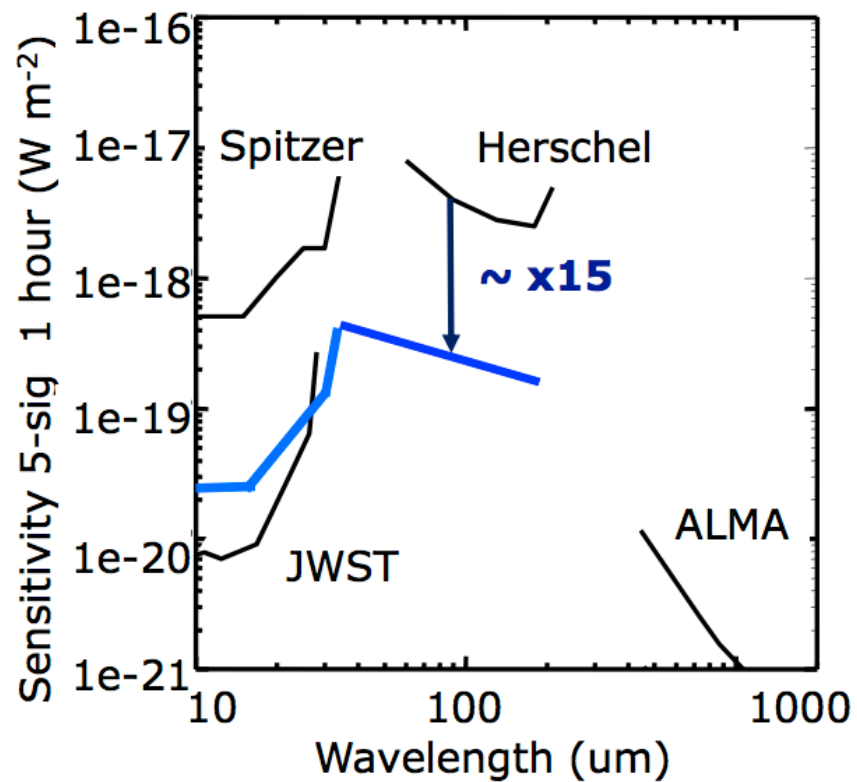


SPICA - Sensitivity

Photometry



Spectroscopy



- Cooled, large aperture telescope with 0.7-210 μm
-> High sensitivity, High spatial resolution.

NASA/IPAC Infrared Science Archive

The screenshot shows the NASA/IPAC Infrared Science Archive website. At the top, the title "NASA/IPAC Infrared Science Archive" is displayed in white text against a dark, starry background. Below the title, the subtitle "for NASA's Infrared and Submillimeter Data" is visible. The main navigation bar includes links for "Home", "About", "Holdings", "Missions", "Documentation", and "Help Desk".

On the left side, there is a vertical menu with categories: "Tools" (Dust Extinction, Mosaic Services, Data Tools, Data Tags), "Data Sets" (WISE, Planck, Spitzer, 2MASS, IRAS, Herschel, COSMOS, PTF, BLAST, MSX, SWAS), and "Help" (IRSA Help Desk, Documentation, FAQ, Video Tutorials). Below the "Help" section, there are "Catalogs" (Search) and "Data Services" (Inventories, Finder Chart, Finder Chart v2 beta, Cutouts, Mission Services). At the bottom of the left menu, there are "Tools" (Dust Extinction, Mosaic Services, Data Tools, Data Tags) and "Data Sets" (IRSA).

The main content area features a search box titled "Search IRSA with the Data Discovery Service". The search box contains the text "Enter an object name or coordinate:" followed by an input field and a red question mark icon. Below the input field, there are examples: "M31", "19h17m32s 11d58m02s Equ J2000", and "46.5377 -0.2518 ga". There is also a field for "Enter a search radius:" with the value "10" and a dropdown menu set to "arcsec", followed by a "Search" button.

Below the search box, there is a date "January 3, 2014" and a blue banner titled "Spitzer Heritage Archive Update". The text below the banner reads: "A new version of the Spitzer Heritage Archive user interface is now available, featuring:" followed by a list of features:

- Access to new versions of the Spitzer Enhanced Imaging Products, and the ability to plot SEDs of objects in the Source List.
- Improved ability to create XY plots of quantities derived from catalog columns.
- Precovery of archival observations of moving objects.

Below the list, there is a date "December 19, 2013" and a blue banner titled "SEIP, SSDF, and SINGS Data Releases".

On the right side, there is a "New" section with a "Finder Chart v2 beta" image and a "WISE Image Service" logo. At the bottom right, there is a "PLANCK" logo and the text "NASA Planck Archive".

- <http://irsa.ipac.caltech.edu/>



Thank you