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

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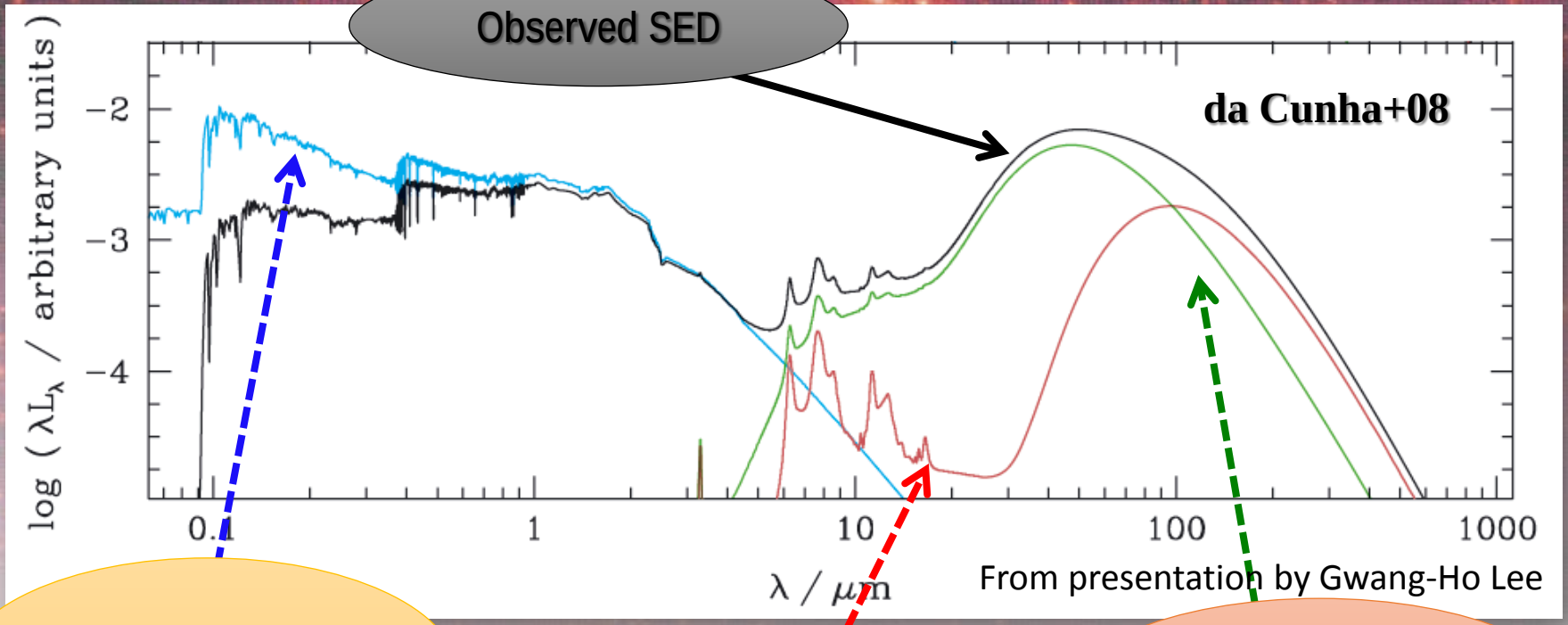
Survey Science Group Workshop

Outline

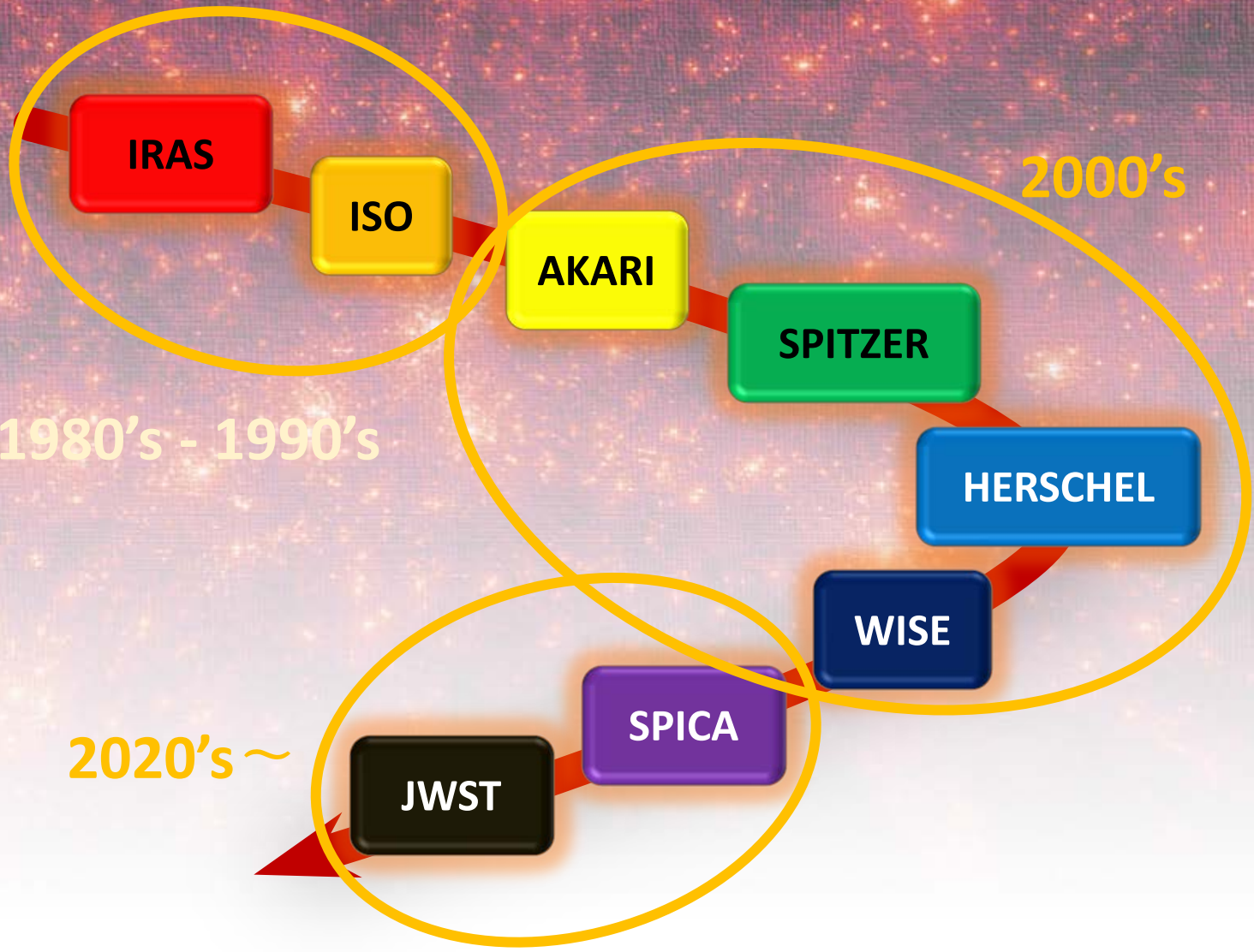
- Why Mid / Far infrared?
- IR space telescopes
  - History
  - Instruments
- IR space surveys
  - KINGFISH
  - SINGS
  - GOODS-Herschel Survey
  - WISE

Why Mid / Far Infrared?

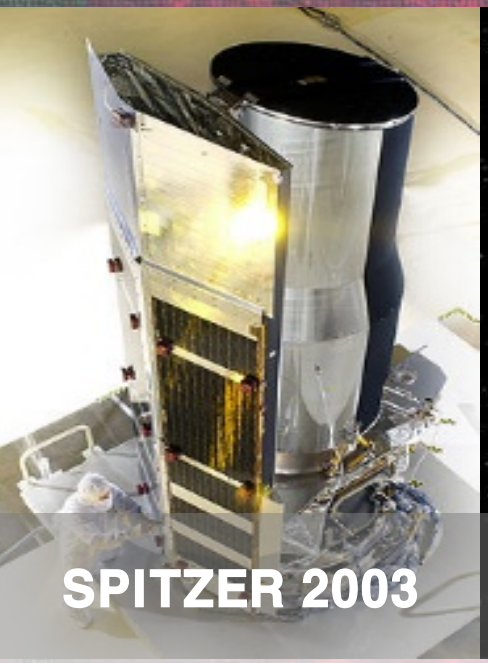


- NIR/MIR spectral features move to MIR/FIR in high redshift

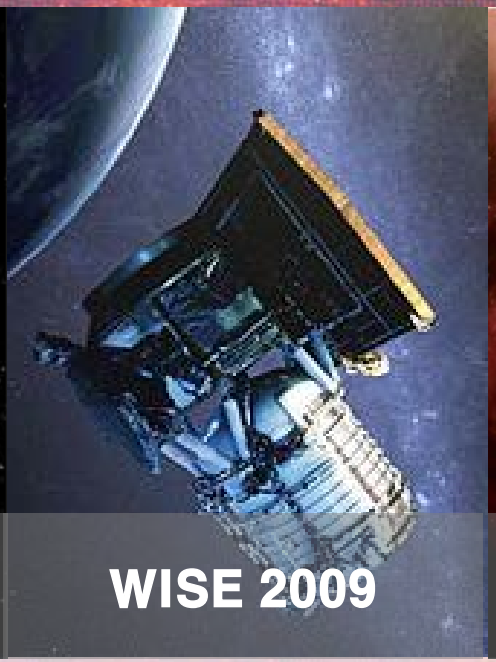
History of IR Space Satellite Missions



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, 8μm	1.22”, R~1000-5000	IM, SP
	IRS	5.2-38μm	R~3-600	SP
	MIPS	24, 70, 160μm	6”, 18”, 40”, R~15-25	IM, SP
HERSCHEL	PACS	55-210μm	3.2”, 6.4”, R~1000-5000	IM, SP
	SPIRE	194-672μm	R~40-1000	IM, SP
	HIFI	157-625μm	$R\sim10^7$	SP
WISE		3.4, 4.6, 12, 22μm	6.1”-12”	IM
SPICA	SAFARI	34-210μm	R~50-2000	SP
	MCS	5-38μm	R~1100-30000	SP
	FPC	0.7-5.2μm	0.3”	IM
	SCI	4-28μm	R~200	IM, SP

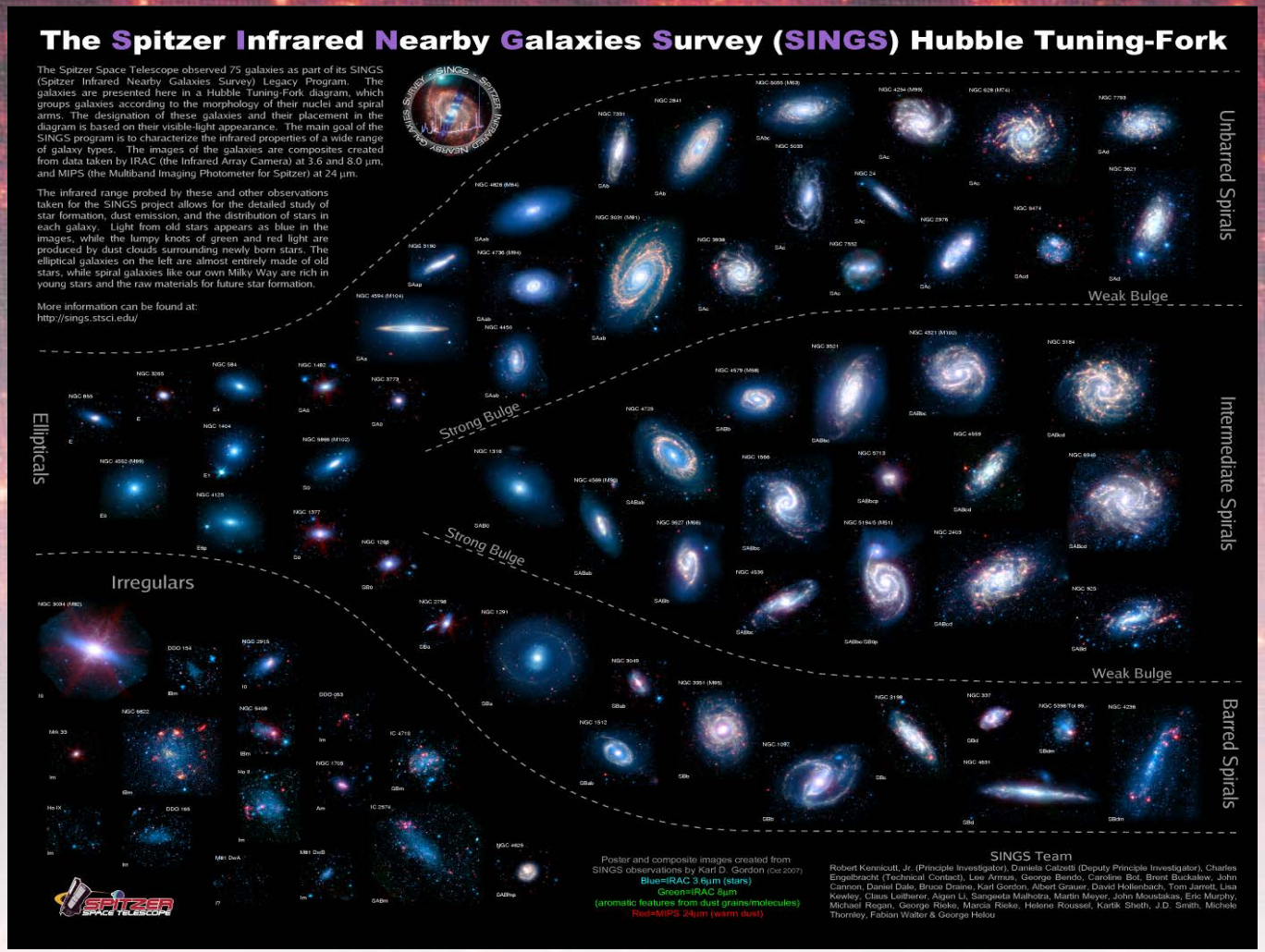
IM = Imager, SP= Spectrograph

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, Taurius-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

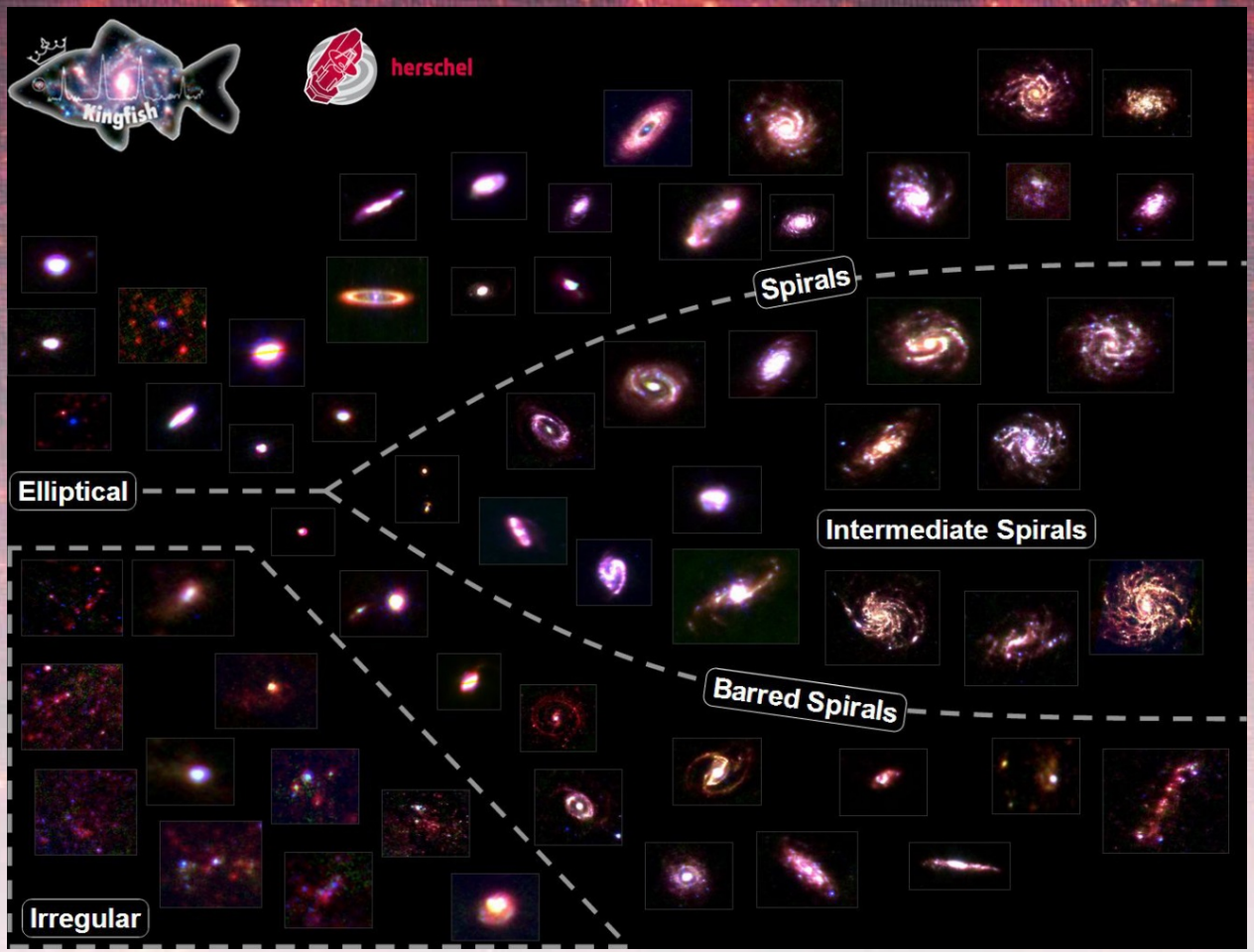
http://herschel.cf.ac.uk/mission/key-programmes/galaxies
http://irsa.ipac.caltech.edu/data/SPITZER/docs/spitzermission/observingprograms/legacy/

SINGS - Spitzer



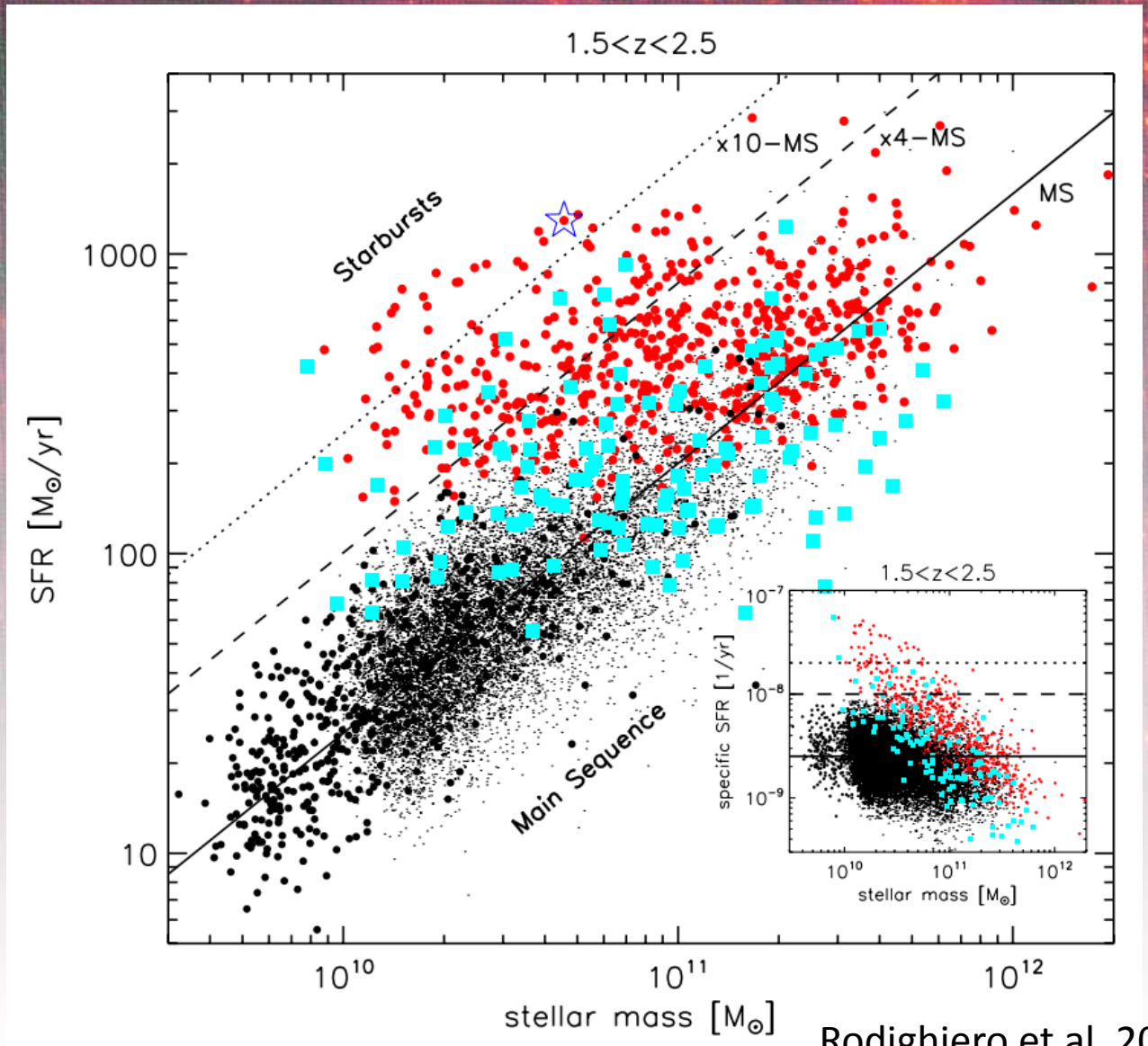
- Imaging and spectroscopic survey of 75 nearby galaxies (d< 30 Mpc)

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

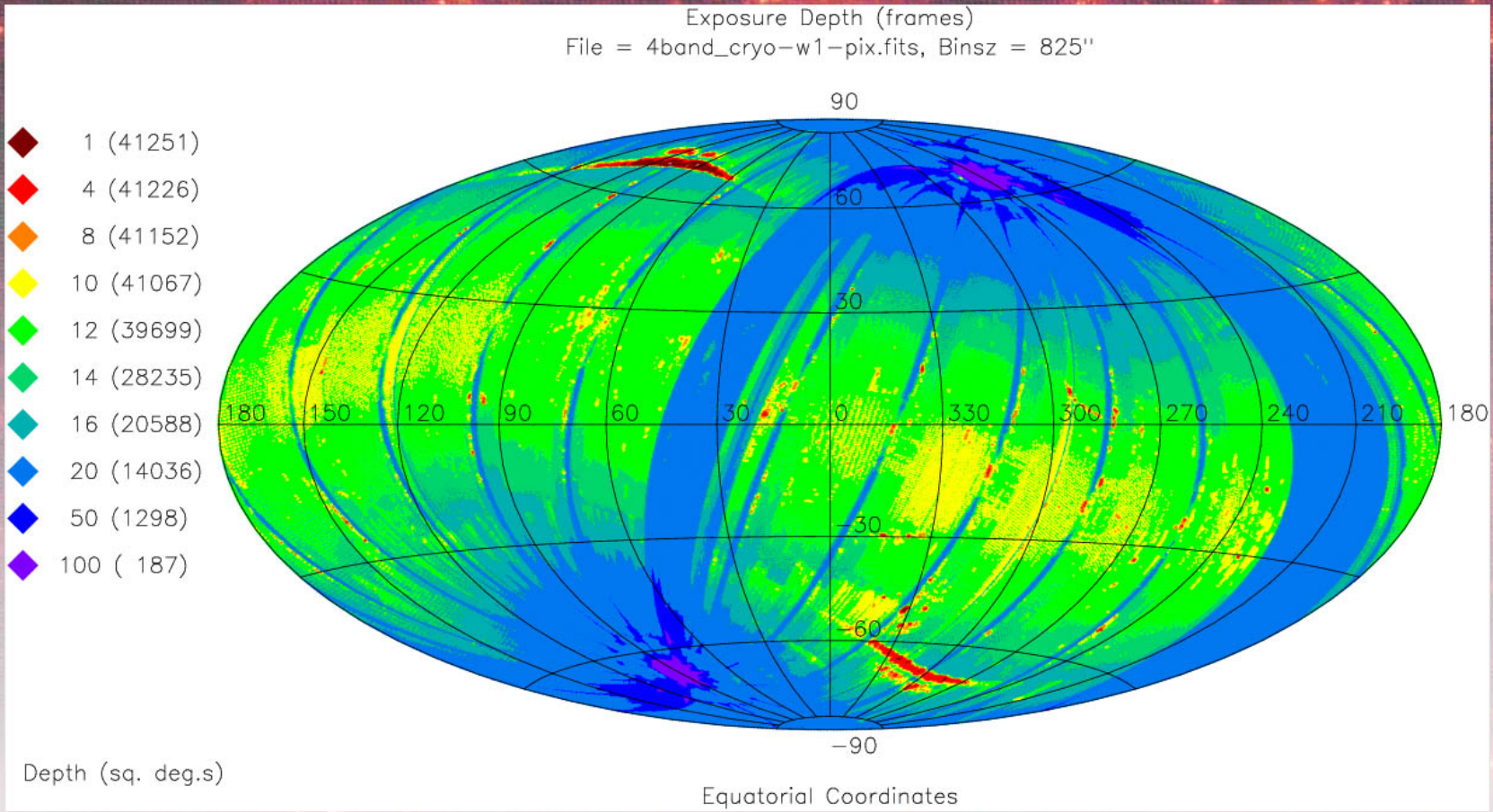
GOODS-Herschel Survey



- MIR: Stellar mass
- FIR: Star formation

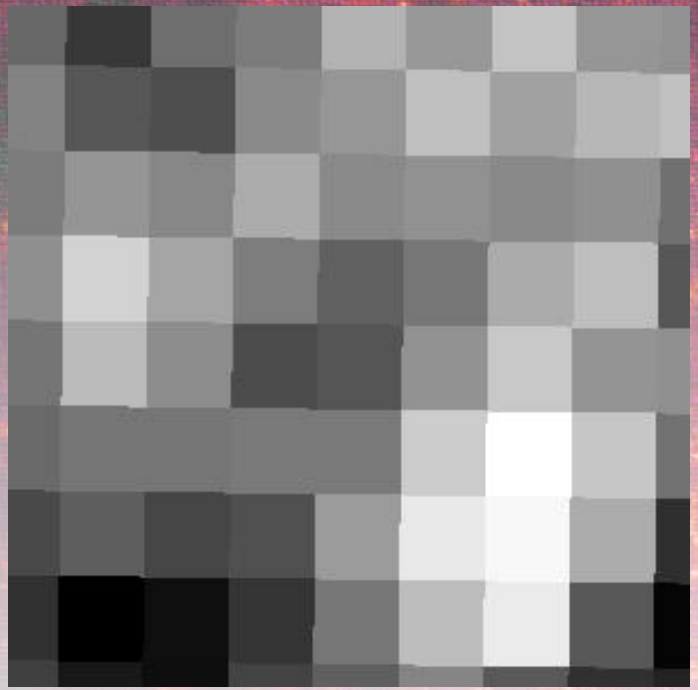
Rodighiero et al, 2011

WISE



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

WISE versus IRAS



IRAS (1983)

WISE (2009)

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

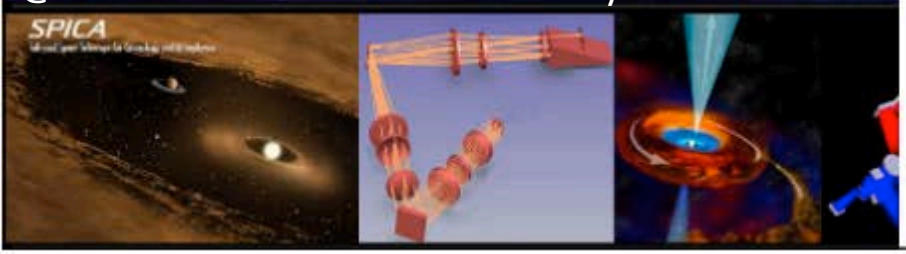
SPICA Overview

3.5 m telescope
Cooled to < 6K

Instruments cover 0.7-210µm

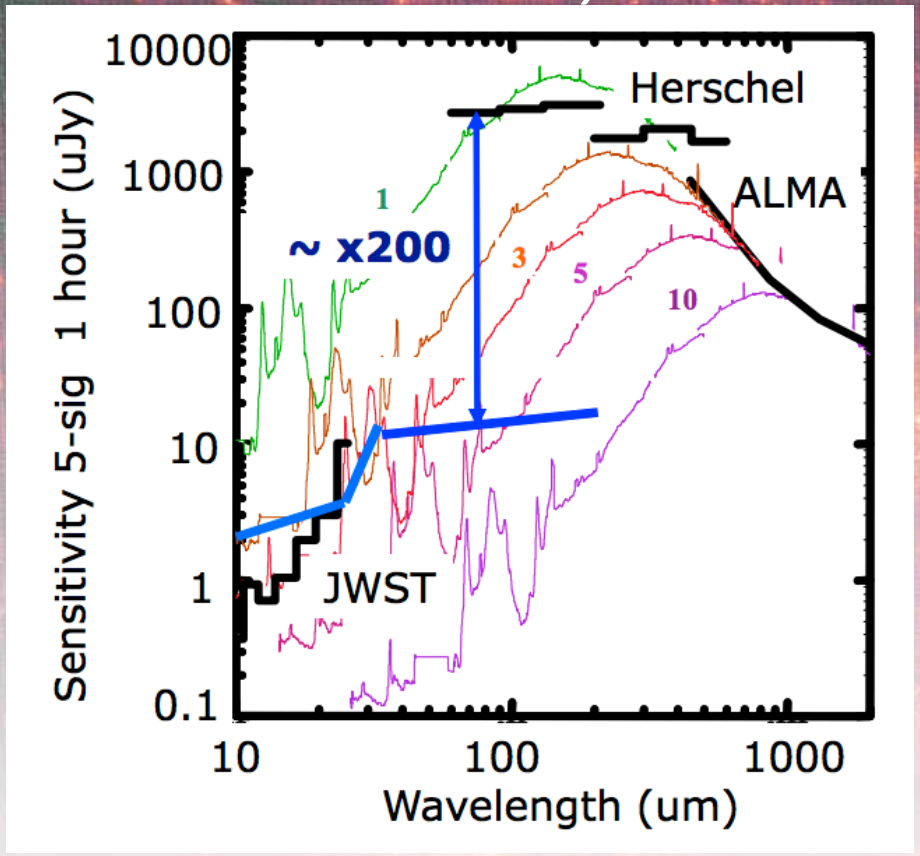
- MIR imaging spectro-photometer
- **FIR imaging spectrometer.**
- MIR Med/Hi Resolution Spec.
- MIR coronagraph
- Focal Plane Camera (guiding)
- LW spectrometer (optional)

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

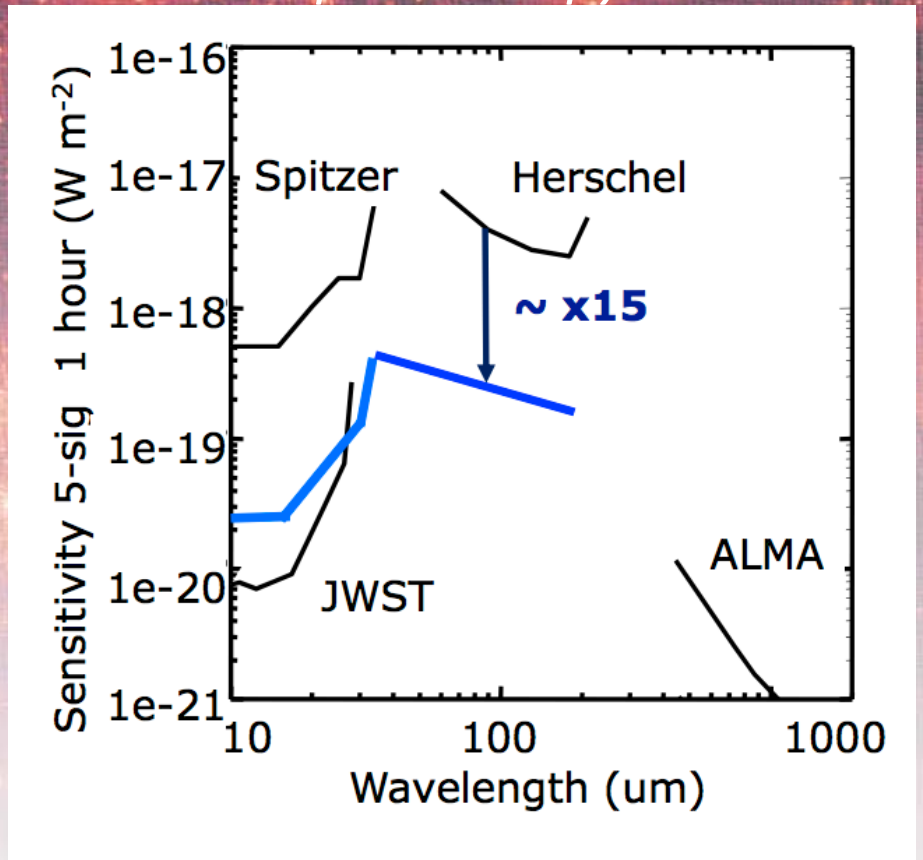


SPICA - Sensitivity

Photometry



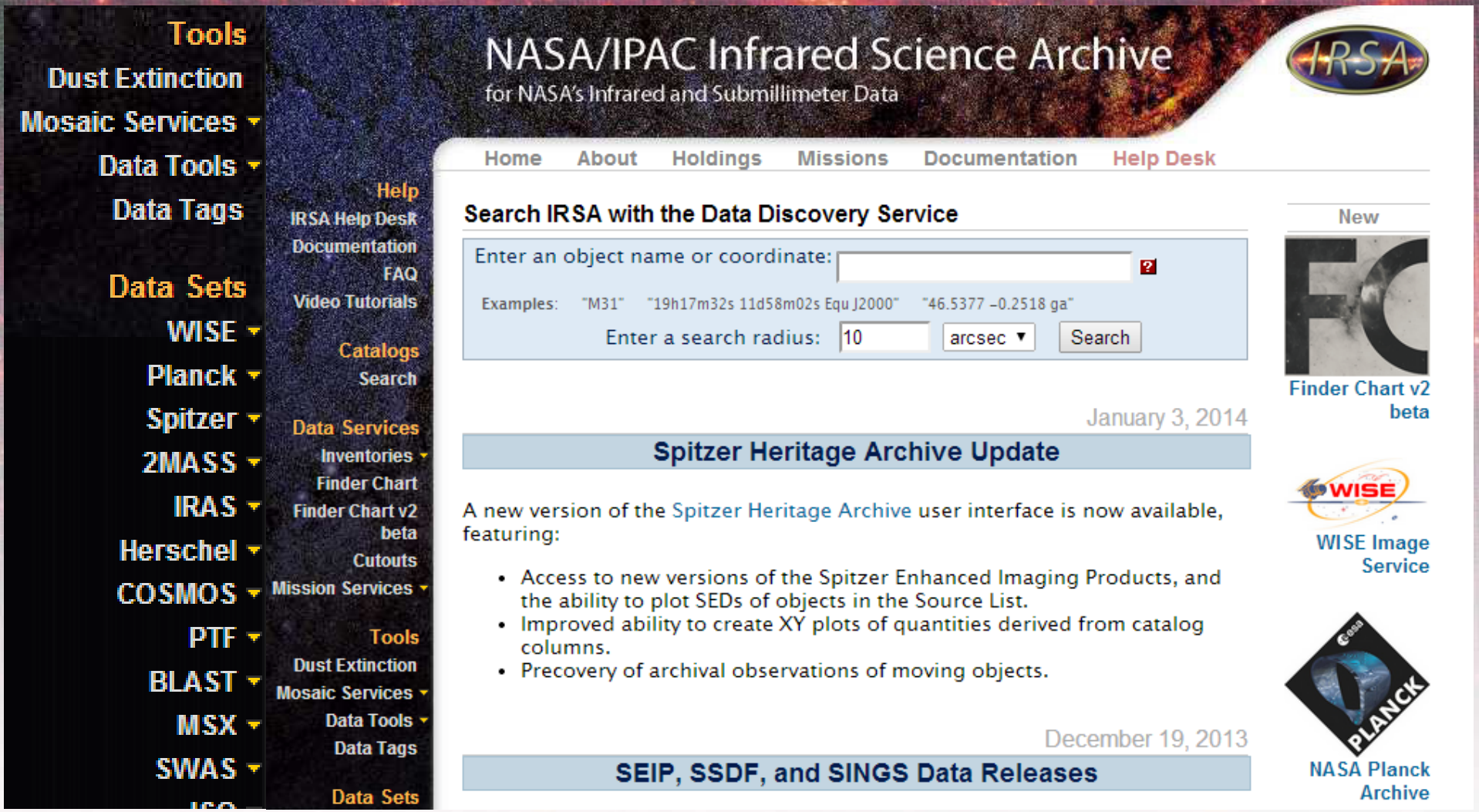
Spectroscopy



- Cooled, large aperture telescope with 0.7-210 µm

-> High sensitivity, High spatial resolution.

NASA/IPAC Infrared Science Archive



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

Thank you