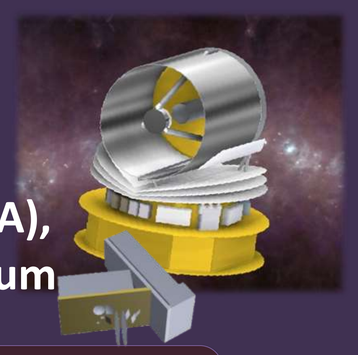
P-081

SPICA Mid-Infrared Instrument (SMI)



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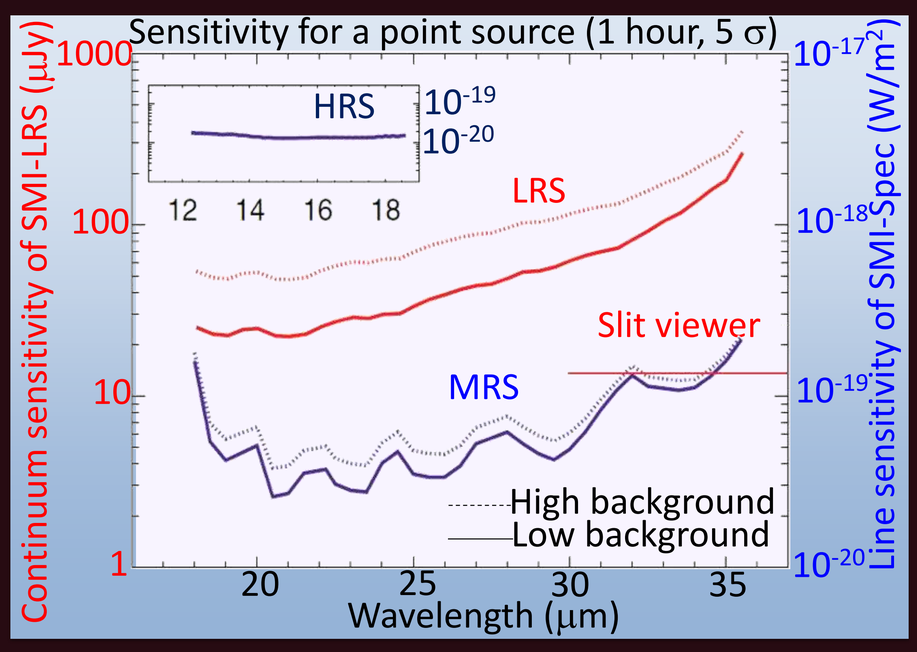
SPICA Mid-infrared Instrument (SMI) is one of the two focal-plane scientific instruments planned for new SPICA. SMI covers a wavelength range of 12–36 μm with the three spectroscopic channels: low-resolution spectroscopy (LRS; 17 – 36 μm, plus broad-band camera at 34 μm), mid-resolution spectroscopy (MRS; 18 – 36 μm), and high-resolution spectroscopy (HRS; 12 – 18 μm).

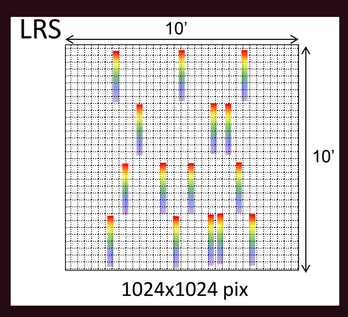
SMI specifications

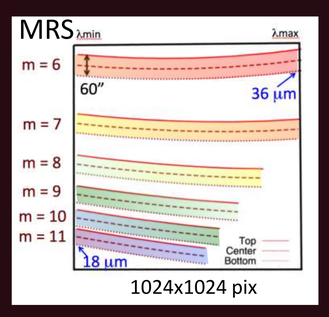
➢LRS: prism (4 slits, 10’ long, R~100), combined with a 10’x10’ slit viewer. High-speed dust-band mapping.

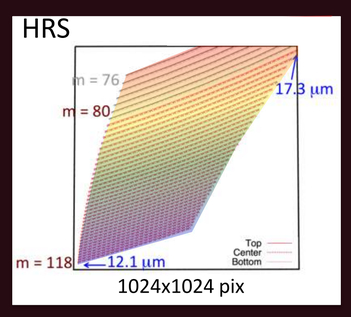
➢MRS: Echelle grating with a cross-disperser (1’ long, R~2000), combined with a beam-steering mirror. High-sensitivity multi-purpose spectral mapping.

➢HRS: immersion grating (R~30000). High-resolution molecular-gas spectroscopy.



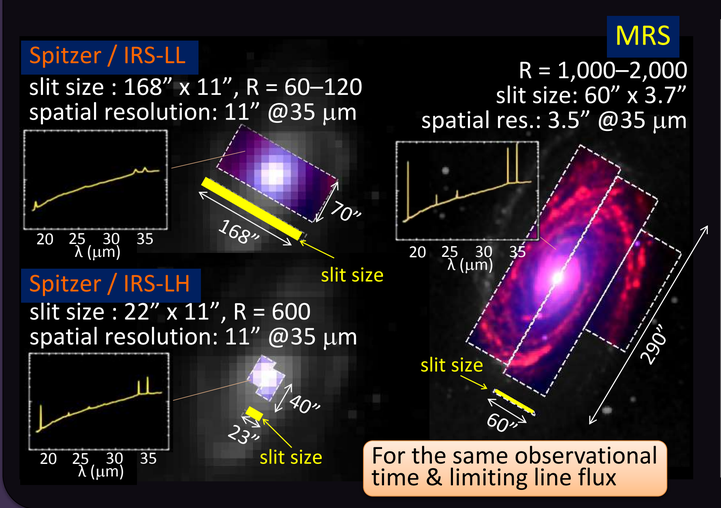


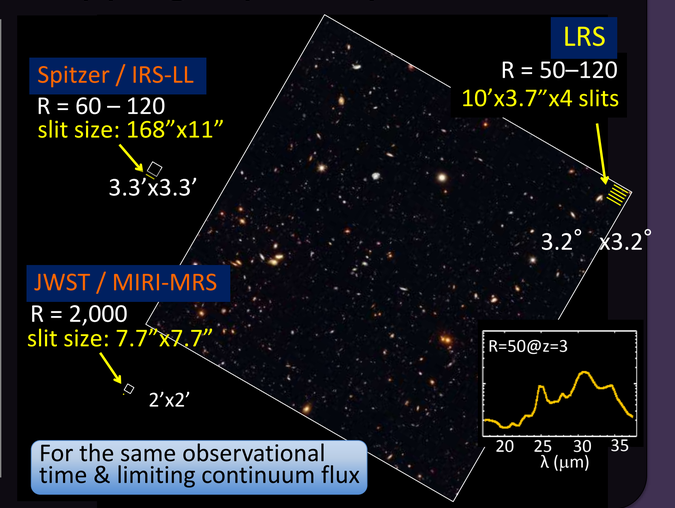




		LRS		MRS	HRS
		Multi slit spec.	Slit viewer		
	Wavelength	17 – 36 μm	34 μm	18 – 36 μm	12 – 18 μm
	Spectral resolution (point source/diffuse)	50 – 120 20 – 110	5	1300 – 2300 1100 – 1400	28000
	Field of View	600”x 3.”7 x 4 slits	600” x 600”	60” x 3.”7 (slit)	4”x1.”7 (slit)
	Beam size	2.”0 (20 μm) – 3.”6 (36 μm), 2.”0 (12 – 20 μm)			
	Pixel scale	0.”7x 0.”7	0.”7 x 0.”7	0.”7	0.”5
Point source	Cont. sensitivity (1 hr, 5 σ)	20 – 200 μJy	13 μJy	300 – 3000 μJy	2 – 3 mJy
Point source	Line sensitivity (1 hr, 5 σ)	(8 – 20) x 10^{-20} W/m²	-	(3 – 20) x 10^{-20} W/m²	(1.5 – 2) x 10^{-20} W/m²
Point source	Survey speed (reaching flux)	~16 arcmin²/hr (100 μJy @30 μm)	~5900 arcmin²/hr (100 μJy @34 μm)	~1.5 arcmin²/hr (3 x10^{-19} W/m²@28 μm)	-
Diffuse	Sensitivity (1 hr, 5 σ)	Continuum		Line	
Diffuse		0.02– 0.1 MJy/sr	0.05 MJy/sr	(0.7 – 4) x 10^{-10} W/m²/sr	(1.5 – 2) x 10^{-10} W/m²/sr
	Saturation limit	~20 Jy	~1 Jy	~1000 Jy	~20000 Jy

Demonstration of SMI mapping capability



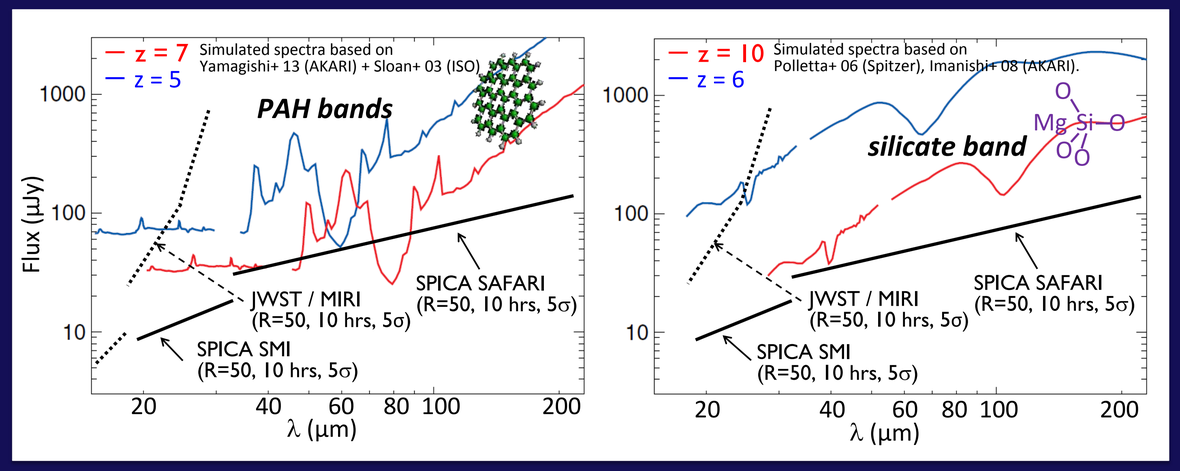


SMI key sciences

LRS surveys will detect organic matters (PAHs) from many high-z galaxies and minerals from many planet-forming disks, while MRS will characterize them. HRS will characterize molecular gases and resolve their velocities in planet-forming disks.

First mineral & organic matter in the Universe

High-z star-forming galaxies (2x10^{13} $L_\odot$) High-z quasars (1x10^{13} $L_\odot$)

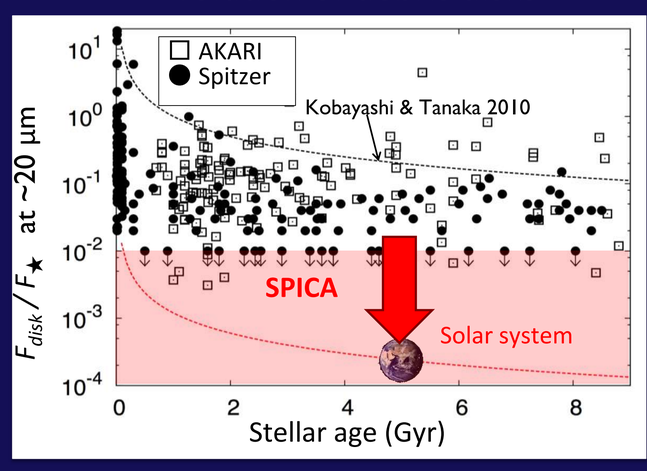


- Detection of PAH bands from galaxies at z up to ~7.
- Detection of dust from quasars at z up to ~10, with dust masses smaller than those detectable by ALMA (<10^6 $M_\odot$).

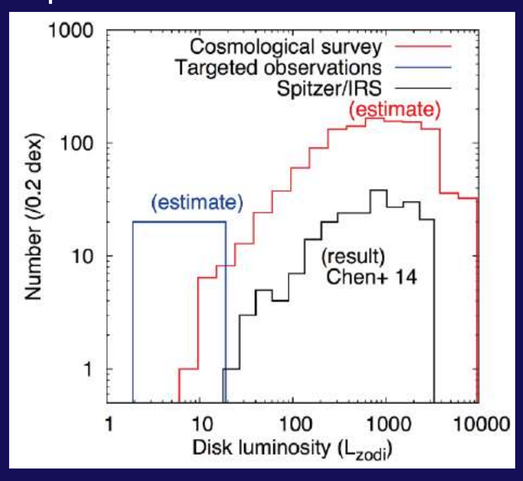
⇒ Characterization of the first mineral & organic matter in the Universe, together with SAFARI data.

Evolution of debris disks to our Solar system

Evolution of debris disks



Expected numbers of detection



- Detection of a large number of debris disks with L_{disk} down to levels close to our Solar system.
- Diagnosis of aqueous minerals (e.g. carbonates) as well as silicates in disks.

⇒ Environmental dependence, conditions for solar nebula