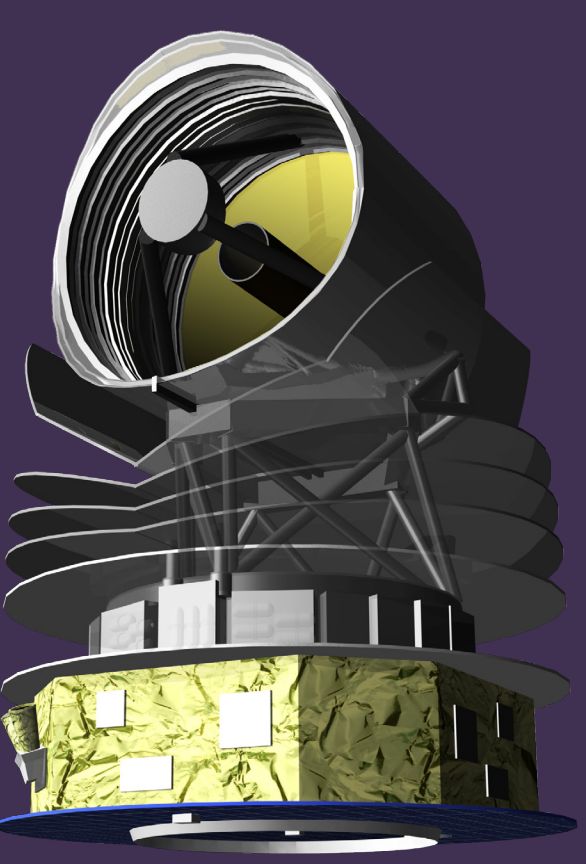


SPICA Mid-Infrared Instrument (SMI)



H. Kaneda, M. Fukagawa, D. Ishihara, S. Oyabu, T. Suzuki (Nagoya Univ.), T. Wada, M. Kawada, K. Asano, T. Nakagawa, H. Matsuhara, J. Kwon, K. Nagase, M. Yamagishi (ISAS/JAXA), I. Sakon (Univ. of Tokyo), N. Isobe (Tokyo tech), K. Tsumura (Tohoku Univ.), H. Shibai, T. Matsuo (Osaka Univ.), and the SMI consortium

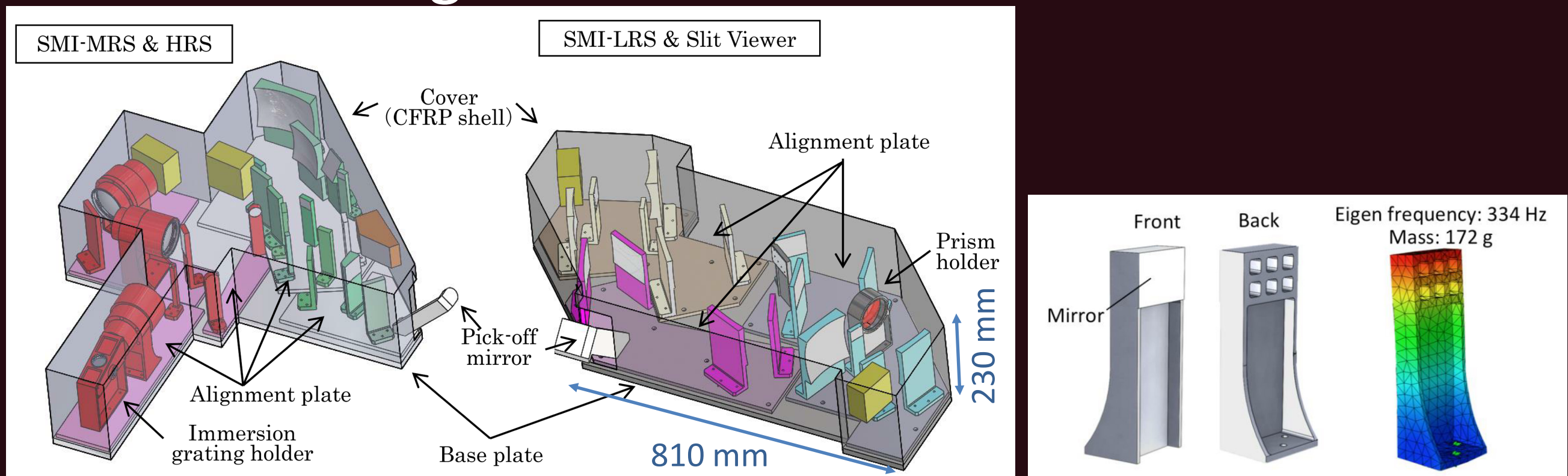
SPICA Mid-infrared Instrument (SMI) is one of the two focal-plane scientific instruments planned for SPICA. SMI covers a wavelength range of 12–36 μm with the three spectroscopic channels: low-resolution spectroscopy (LRS; 17 – 36 μm , plus broad-band camera at 34 μm), mid-resolution spectroscopy (MRS;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

SMI specifications

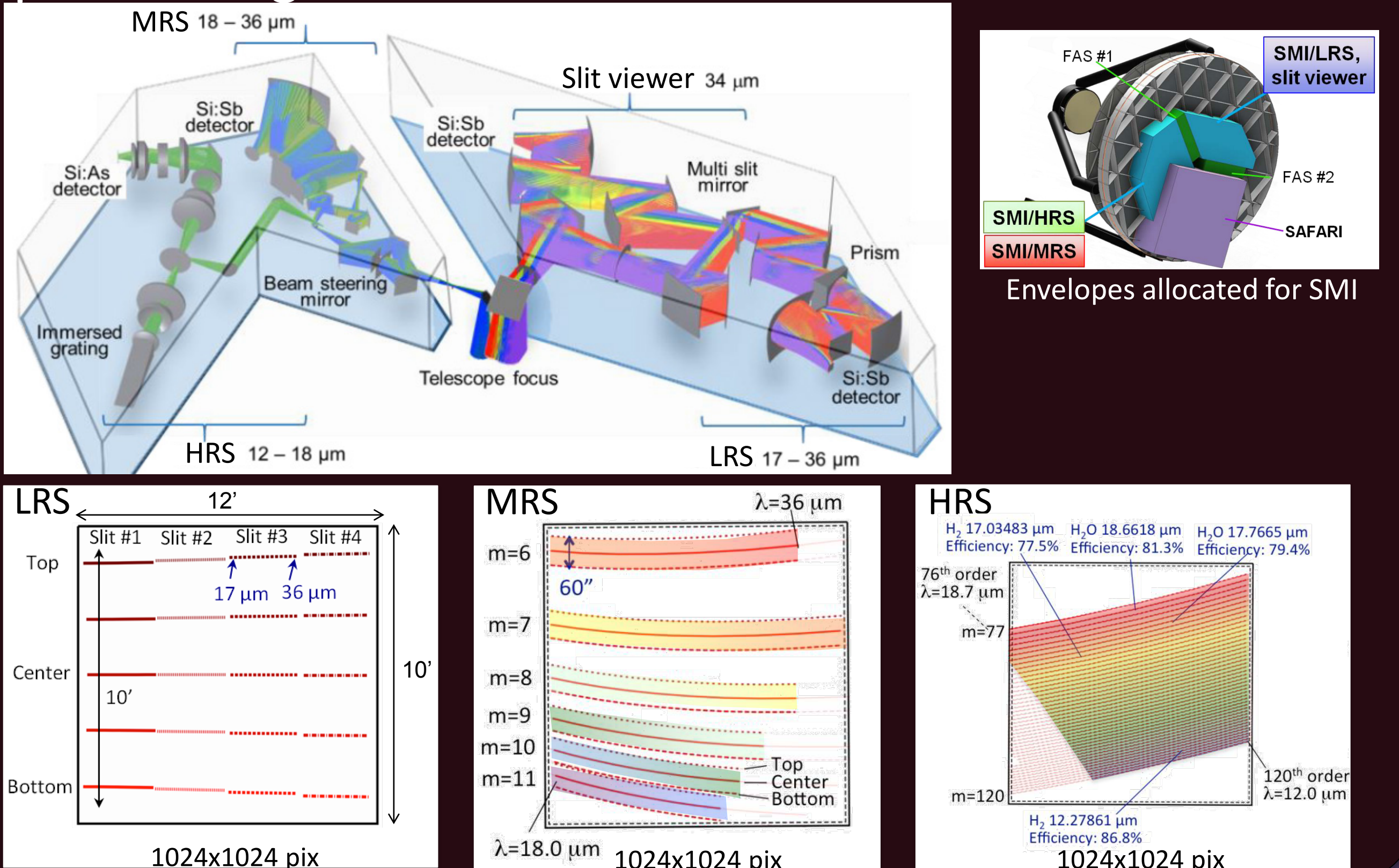
Parameter	LRS	Slit viewer for LRS	MRS	HRS
Band center - μm	27	34	27	15
Wavelength - μm	17 – 36	34	18 – 36	12 – 18
Spectral resolution R (diffuse source)	50 – 120 (20 – 110)	5	1300 – 2300 (1100 – 1400)	28000
Field of view	600" x 3.7"	600" x 720"	60" x 3.7"	4"x1.7"
Band centre FWHM	4 slits	1 slit	1 slit	1 slit
Pixel scale	2.7"	3.5"	2.7"	2"
Detector 1K x 1K	0.7" x 0.7"	0.7" x 0.7"	0.7"	0.5"
Point source sensitivity				
Continuum - Jy	50	13	400	1500
Line - 10^{-20} W/m ²	8	4	1.5	1.5
Survey speed - arcmin ² /hr	~16 (100 μJy @ 30 μm)	~5900 (100 μJy @ 30 μm)	~1.5 (3 x 10^{-19} W/m ² @ 28 μm)	
Diffuse source sensitivity (5σ , 1 hr)				
Continuum - MJy/sr	0.05	0.05	1	1.5
Line - 10^{-10} W/m ² /sr				
Saturation limit - Jy	~20	~1	~1000	~20000

- **LRS**: prism (4 slits, 10' long, $R \sim 100$), combined with a 10'x12' slit viewer. **High-speed dust-band mapping.**
- **MRS**: Echelle grating with a cross-disperser (1' long, $R \sim 2000$), combined with a beam-steering mirror. **High-sensitivity multi-purpose spectral mapping.**
- **HRS**: immersion grating ($R \sim 30000$). **High-resolution molecular-gas spectroscopy.**

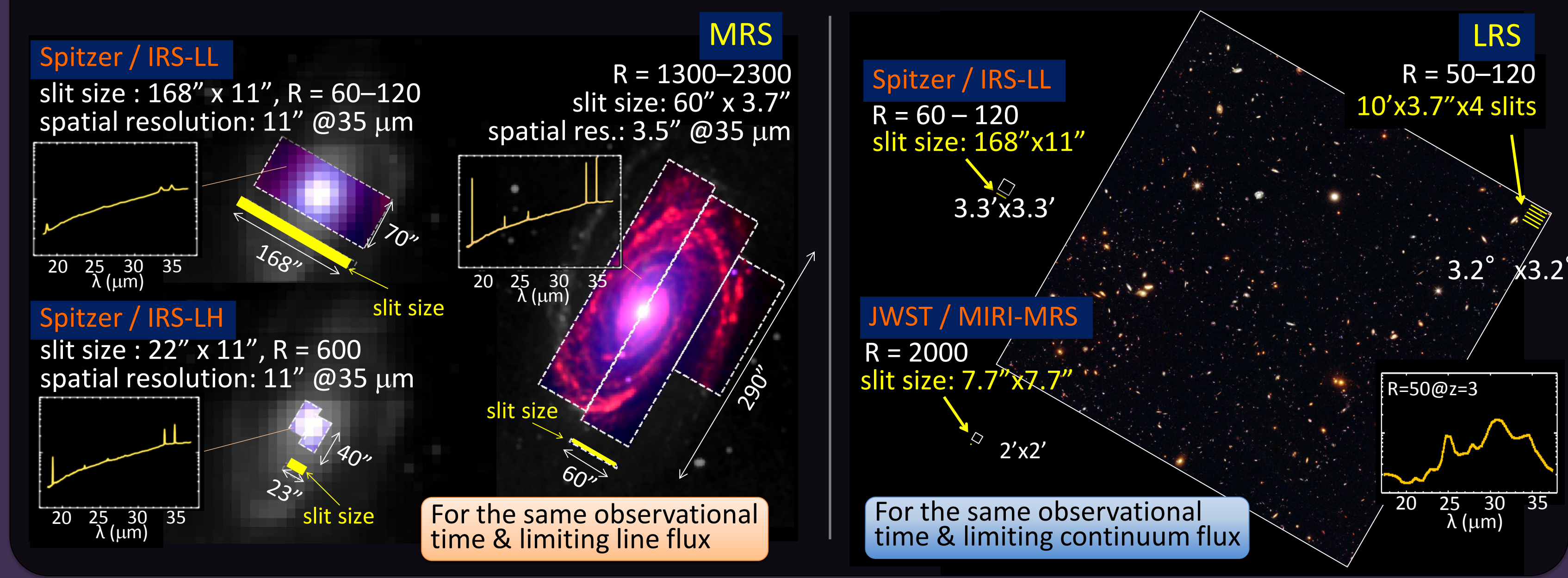
Mechanical design



Optical design



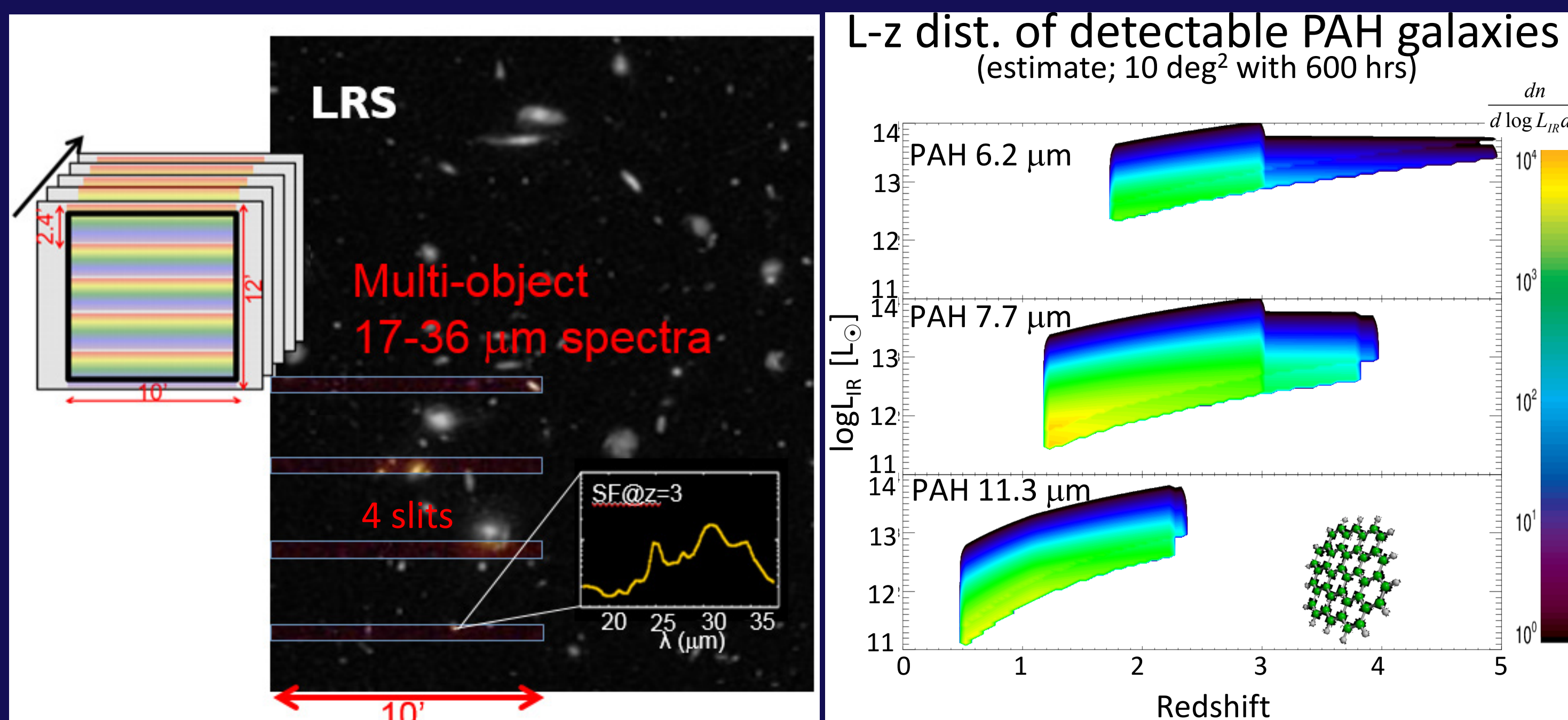
Demonstration of SMI mapping capability



SMI key sciences

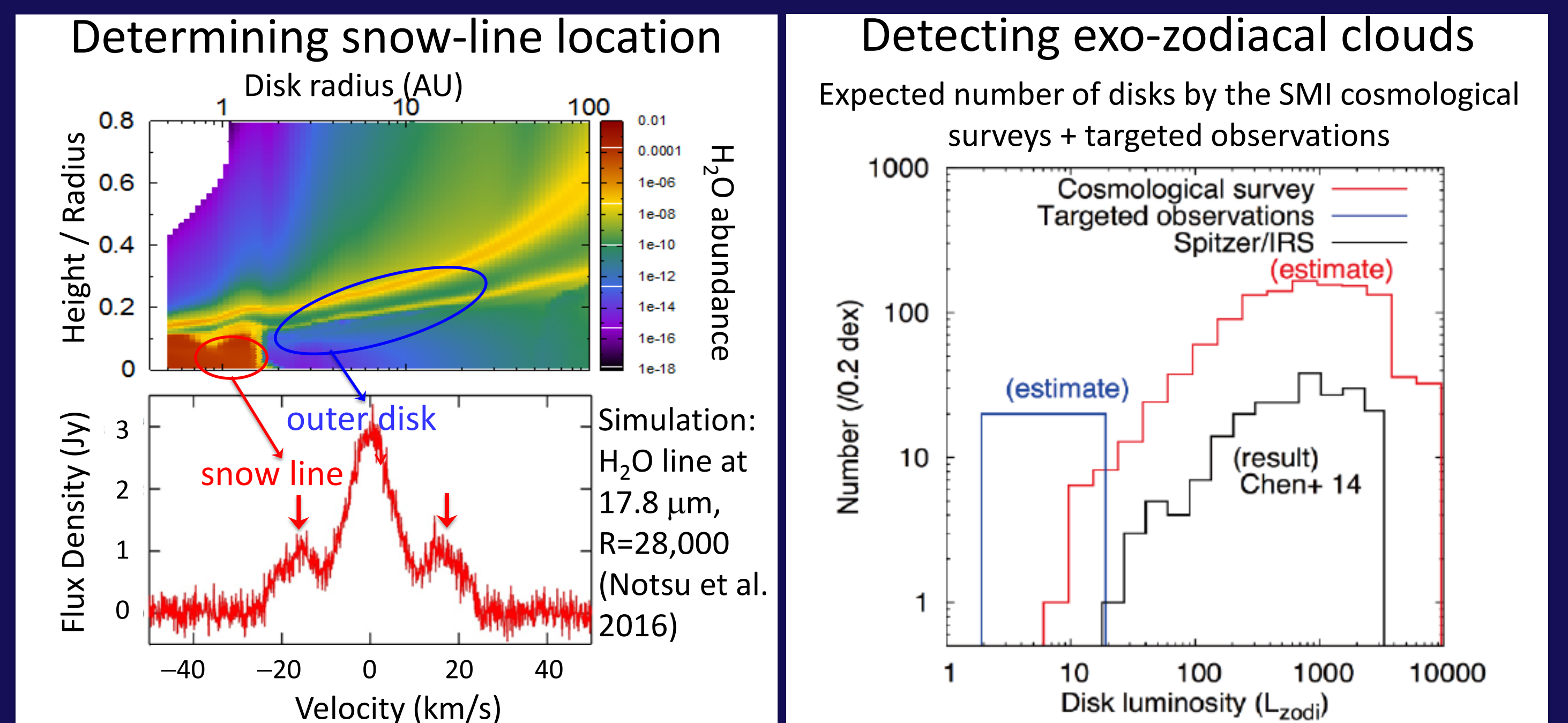
LRS surveys will detect organic matters (PAHs) from many high- z galaxies and minerals from many planet-forming disks, while **MRS** will characterize them. **HRS** will characterize molecular gases and resolve their velocities in planet-forming disks.

PAH galaxy survey in the Universe



- Wide area spectroscopic survey with **LRS** (10 deg²; 600 hrs)
 - ⇒ Detection of **~50000 PAH galaxies** at z up to 5
 - ⇒ Diagnosis of PAH galaxies, & provision of targets for **MRS** and **SAFARI**
 - ⇒ Characterization of PAH galaxies in the Universe

Protoplanetary/debris disks to our Solar system



- High-resolution spectroscopy with **HRS**
 - ⇒ Planet formation and evolution by probing gas dispersal, determining snow-line location
- Wide area survey and targeted observations with **LRS**
 - ⇒ Debris disks down to levels close to **our Solar system.**