

# Near-Infrared Instrument for SPICA : FPC-S (Focal Plane Camera – Science)

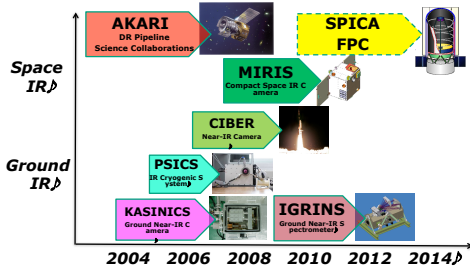
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## 1. Introduction

- Based upon the previous collaboration in IR projects between Korea and Japan, Korea propose the near-infrared instrument for SPICA, **FPC (Focal Plane Camera)**.
- The FPC consists of two parts; one is **FPC-S** (fine Guider) and the other is **FPC-G** (Science).
- The primary function of the FPC-S is the **back-up system of FPC-G** and it also performs **scientific observations**.
- It has a capability of **wide-band imaging as well as imaging spectroscopy** using LVF (Linear Variable Filter).
- Korea Astronomy & Space Science Institute (KASI) will lead the development, assembly and test of the FPC-S.

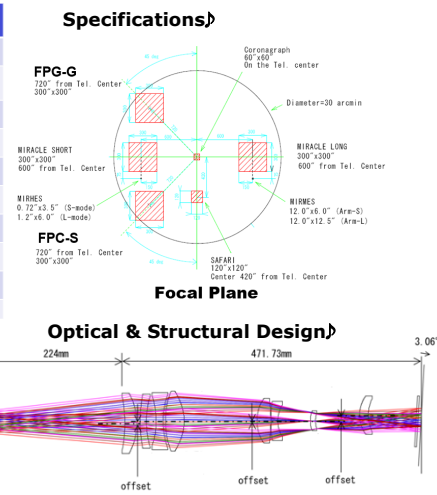
### Korea's involvement in IR Projects



## 2. Specifications of the FPC-S

Parameters	Specification
Optics	Refractive optics with lens
Detector Array	1K x 1K InSb
Field-of-View	5 arcmin. x 5 arcmin.
Pixel Scale	0.3 arcsec.
Readout Speed	100 – 600 sec
Wavelength Range	0.7 – 5μm
Wavelength Resolution	R=5 (imaging) – 20 (spectroscopy)
Filter Positions	10 (1 blank, 1 back-up of FPC-G, 5 wide band filters, 3 LVFs)
Sensitivity	27.3 mag (AB), 600 sec, 3σ, imaging 26.3 mag (AB), 600 sec, 3σ, LVF
Operating Temperature	Structure at 4.5K, Detector at 10K
Cold Mass	7 kg with 20% margin
Heat lift at 4.5K [mW]	2 / 0.2 (observing / stand-by)
Electric Power [W]	12 / 12 (observing / stand-by)

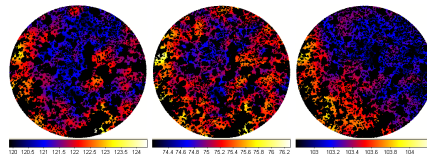
Filter position	Filter
F1	blank (cold shutter)
F2	diffuser + I (0.8μm) (back-up of FPC-G)
F3	LVF-1, (0.7 ~ 1.6μm)
F4	LVF-2, (1.4 ~ 2.8μm)
F5	LVF-3, (2.6 ~ 5.2μm)
F6	J (1.2μm)
F7	H (1.6μm)
F8	K (2.2μm)
F9	L (3.5μm)
F10	M (5.0μm)



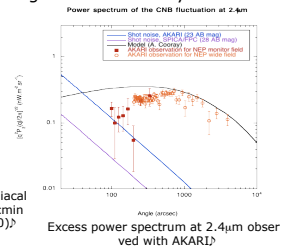
## 3. Scientific Targets

### 3.1 Legacy Programs

- Near-Infrared Spectroscopic Survey with FPC for Cosmic IR Background and Extragalactic Sciences (NIRSS)
  - Wide Field Spectroscopic Survey with LVF (R~20)
  - Primary Science: Cosmic Infrared Background Fluctuation and Spectrum**
    - Measurement of the spectrum of the sky to examine the nature of the excess background emission
    - Detection of the fluctuation of the sky brightness caused by Pop.III stars.

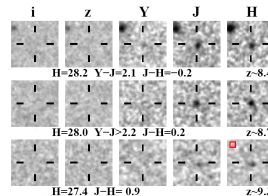


Soothed image of infrared excess emission after subtracting the contributions from Zodiacal light and point sources of Monitor field observed by AKARI. Angular diameter is 10 arcmin and wavelength band is 2.4, 3.2 and 4.1μm from left to right (Matsumoto et al. 2010)

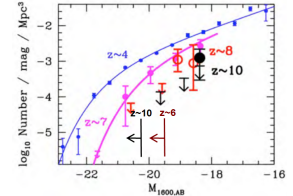


### Secondary Sciences: Lyman Break Galaxies up to redshift 10, Emission Line Galaxies

- Understanding of high redshift star formation history of the Universe and the reionization
- Direct detection of Lyman break galaxies (z~5 – 10)

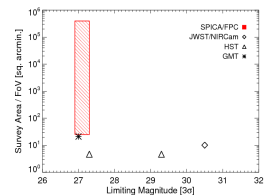


LBG samples from HST observation (Bouwens et al. 2008). The red square shows the pixel scale of FPC-S.



UV luminosity function at z~4, 7, 8 and 10 (Bouwens et al. 2010). Two vertical lines show the sensitivity limit at rest frame for z=6 and 10, respectively.

- Parallel Imaging Survey for Extragalactic Sciences
  - Parallel observations with other instruments
  - Wider areal and spectral coverage
  - 180 deg<sup>2</sup> (5-year lifetime, 4 filters)



### 3.2 Target of Opportunities: Comet Observations, Gamma Ray Bursts ...

## 4. Development & Test Plan

Sub-systems	Task	2010	2011	2012	2013	2014	2015	2016	2017
Band	• Launch								
	• Design								
	• Fabrication/assembly								
	• Assembly/test (science)								
Focal Plane Assembly	• Design								
	• Fabrication								
	• Assembly/test (science)								
	• Integration/test (science)								
Warm Electronics	• Design								
	• Fabrication								
	• Assembly/test								
	• Integration/Calibration								

### \* Related Papers

Bouwens et al. 2008, ApJ, 686, 230  
Matsumoto et al. 2010, ApJ, Submitted

Bouwens et al. 2010, Nature, Submitted