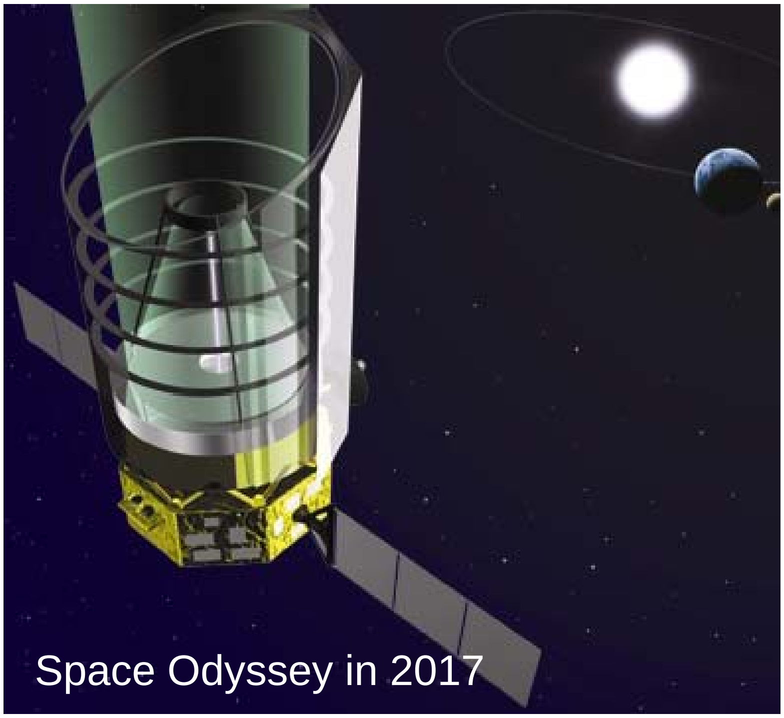
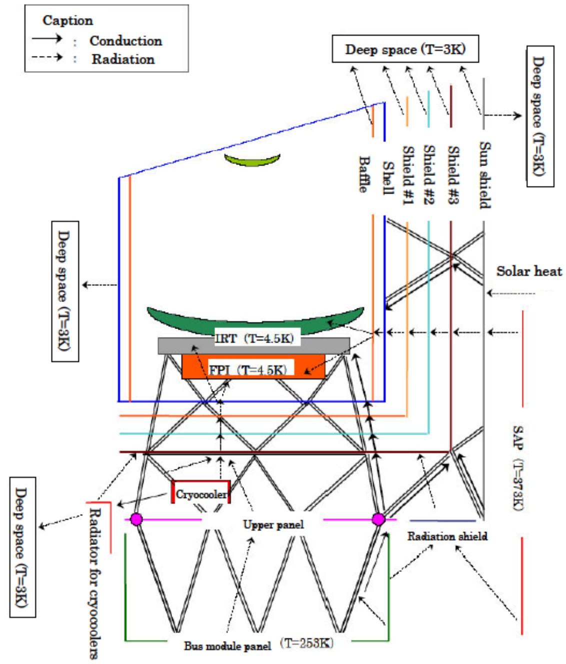
http://www.ir.isas.jaxa.jp/SPICA/

SPICA: *The World's First Large, Cryogenic Far-IR Space Telescope*





Warm launch, cooling in orbit by cryocoolers

SPICA Key Facts

Lead Agency: ISAS / JAXA, working group centered at ISAS , NAOJ, Japanese Universities (PI: T. Nakagawa)

Aperture: 3.5 m, telescope potentially provided by ESA, likely based on Akari / Herschel silicon-carbide technology.

Temperature: 4.5 K, via careful design with radiative cooling and closed-cycle coolers (no liquid cryogens) -> JAXA / Sumitomo cryocoolers world-leading.

Orbit: Earth-Sun L2 halo, a thermally-favorable location

Lifetime: 5 years, not limited by cryogens

Programmatic Style: Great Observatory with key projects, legacy science teams, international participation.

Timescale: Phase A ~ 2008--2010, Instrument selection ~ 2010--2011, **Launch ~ 2017 (this decade!!)**

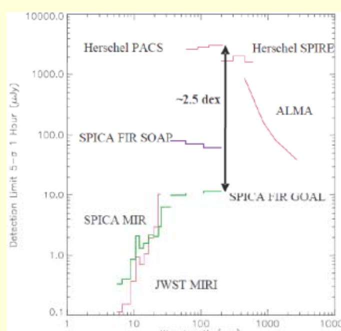
SPICA Proposed Instrument Suite

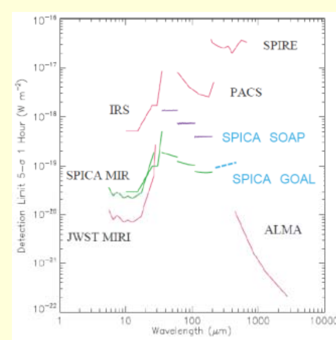
Mid-IR Imager / Spectrometer (Japan / Korea)
- Imaging and R~200 grism spectroscopy w/ 180-280 arc second field of view.
- Long-slit R=3000 spectroscopy at 4-38 μm
- R=30,000 spectroscopy at 5-18 μm.

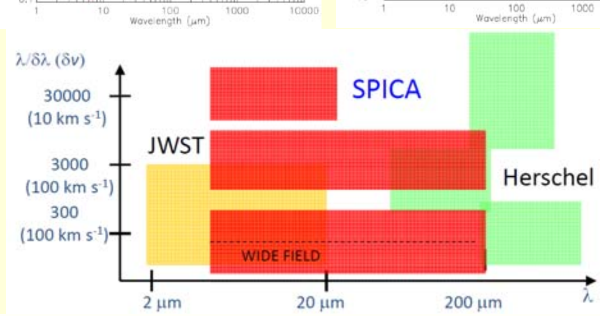
Mid-IR Coronagraph (Japan / Korea)
- 5-27 μm core range with contrast > 10^6.
- Inner working angle 2-5 λ/D, outer working angle 10-30 λ/D.

SAFARI (European Consortium)
- baselined as 30-210 μm imaging Fourier-transform spectrometer (IFTS), 2 x 2 arcmin FOV.
- R variable from 10 to a few 1000.
- Detectors TBD; Ge photoconductors or bolometers.

Potential US Instrument (see page 2)







Potential US contributions to SPICA: Sensitive Detectors and Instruments

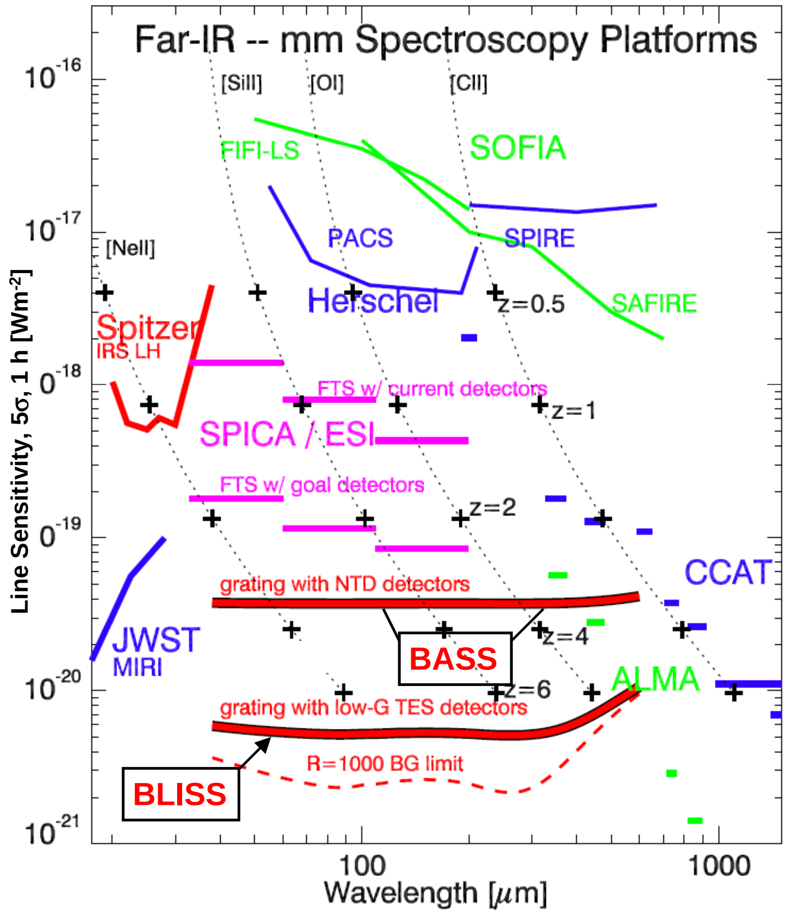
Huge advances are possible in the far-infrared with a cold telescope

• Ultimate sensitivity limitation is the astrophysical backgrounds with ~1000-10,000 times lower noise.
• **Spectroscopy of sources in the early universe (z~1-5) is possible with a cryogenic space telescope and sensitive instrumentation.**
• But reaching the background limit requires new detectors with NEP approaching 4×10^{-20} W $Hz^{-1/2}$ for a R~1000 grating.

Cryogenic Bolometers in the US

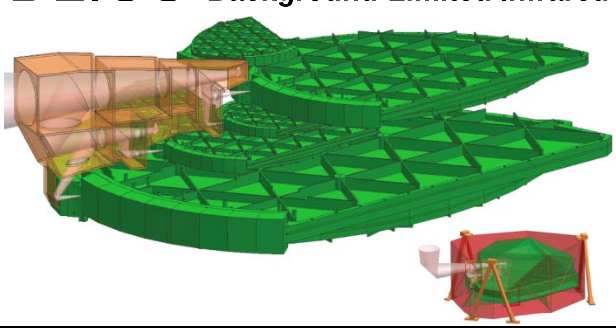
Semi-conducting neutron-transmutation-doped (NTD) bolometers with JFET readouts developed for SPIRE, Planck (Bock et al.)
• Very well-behaved, excellent quantum efficiency, built for flight,
• But individually read-out -> formats limited to 1-2 x 1000 detectors
• And NTD bolometer sensitivity is limited to ~3e-19 W $Hz^{-1/2}$ due to heat capacity

• **Superconducting bolometers (TES) can overcome format and sensitivity limitations**: have superconducting MUX, and greater response speed allows sensitivity in low 10^{-20} W $Hz^{-1/2}$ range (still requires some demonstration).

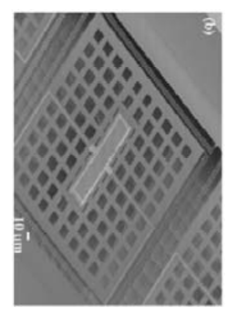


US Concept -- A Broadband Grating Spectrograph: Two Approaches

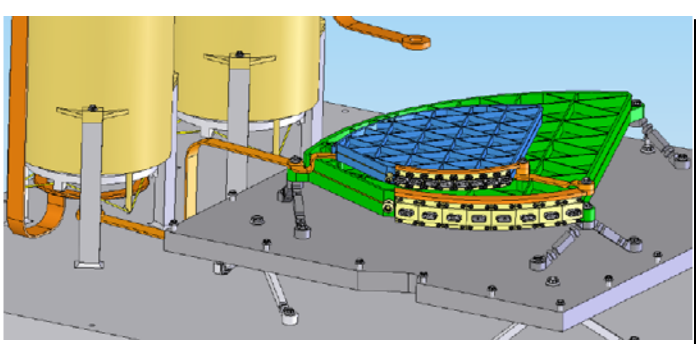
BLISS **Background-Limited Infrared-Submillimeter Spectrograph -> *goal instrument***



• full 38-430 μm coverage in 5 bands at R=700
• 4200 superconducting bolometers with sensitivity approaching the background limit.
• cooled to 50 mK with magnetic refrigerator
• two beam on the sky, modulated by cold chopper



BASS **Bolometer Array Survey Spectrograph -> *very low risk, proposed to SMEX MoO call***



• full 132-320 μm coverage in 2 bands at R=300
• 320 semiconducting bolometers based on technology developed for Herschel and Planck, ready to build now.
• cooled to 50 mK with magnetic refrigerator
• two beam on the sky, modulated by cold chopper