Key Science with SPICA: Galaxy Evolution and Mass Assembly

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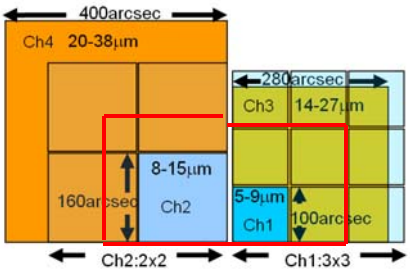
Mid to far-infrared imaging & low-resolution multi-object spectroscopic capabilities of SPICA will enable us to understand the dust obscured galaxy evolution and mass assembly history of the Universe out to z~5

Key Scientific Objectives: Summary

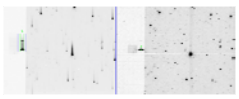
SPICA Wide-Field Mid-IR Imager



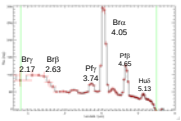
- Resolve the Cosmic InfraRed Backgroud : the energy production history of the universe, a half of which is hidden by dust
- Search for Buried (dust-obscured) Super Massive Black Holes in distant (z=2~3) Ultra-Luminous Infrared Galaxies (ULIRGs)
- Mass Assembly / Star-formation History of the Universe : higher –z, smaller mass than achieved with Spitzer & AKARI

Multi-object Spectroscopy

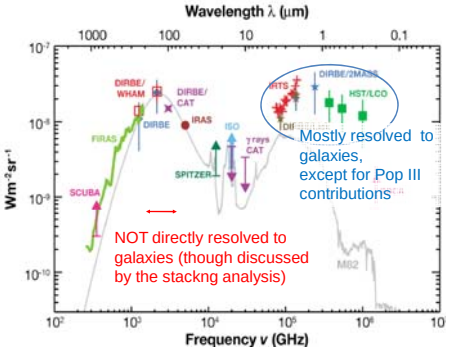
SPICA MIR imagers will incorporate slitless spectroscopic mode with a low-dispersion Grism like AKARI/IRC (Ohyama et al. 2007)

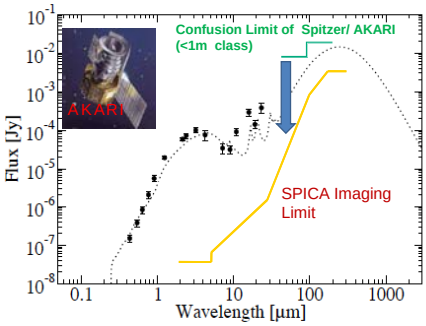


Dispersed Image with a prism | Reference Image



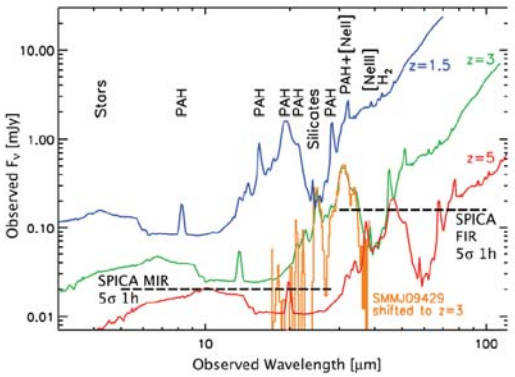
Resolving Cosmic IR Background





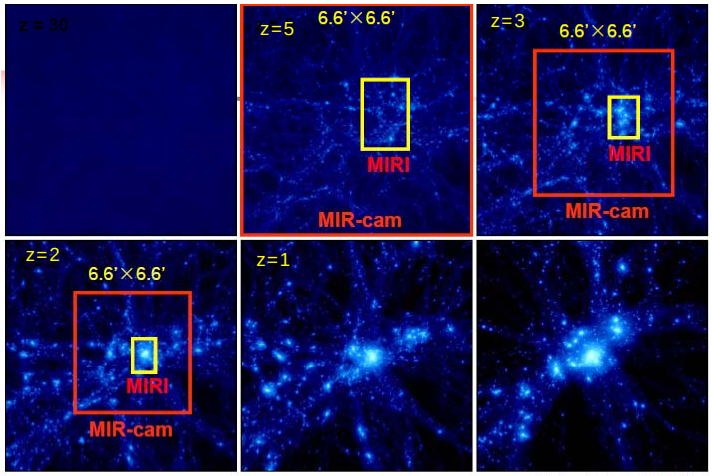
Large aperture (3.5m) telescope of SPICA enables us to overcome the serious confusion limit which prevent us with ~1m class telescope from resolving the cosmic far-infrared background. See dramatic gain especially at 50-90 microns.

low-R spectroscopy with SPICA

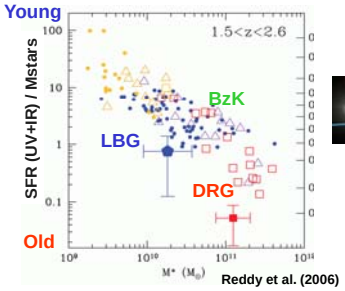


SPICA will have the sensitivity in low-resolution mode (R~100) to detect PAH/silicate features in dusty distant galaxies out to z~3 in 1 hour's integration, and out to z>4 in 10 hours. These features provide important pointers to the physical processes powering distant dusty galaxies.

Mass assembly & Star-formation History hidden by dust

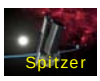


A Massive Cluster (6×10^{14} $M_\odot$), 20×20Mpc^2 (co-moving) Yahagi et al. (2005)



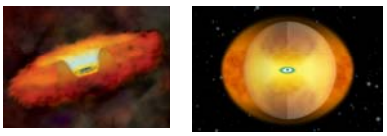
Reddy et al. (2006)

Galaxy Evolution with (SFR/M* vs M*) diagram

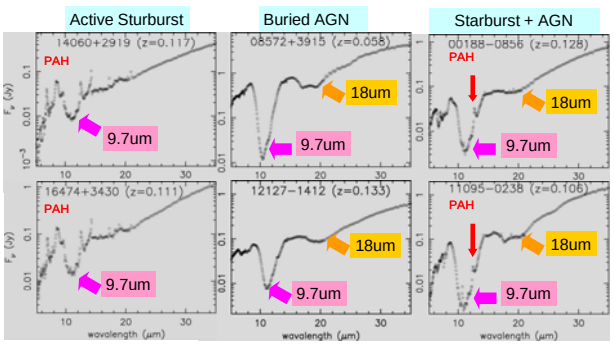


"Galaxy Zoo" should be understood by a general diagram describing the star-formation activity in the universe.
SPICA will achieve sensitivities >10 times deeper than Spitzer.
→ Can go to higher z, smaller stellar mass (M*)

Search for Buried (dust-obscured) Super Massive Black Holes in ULIRGs



AGN with torus (left) can be studied by optical spectroscopy, however many AGN are buried in dusty cloud (right)
→ energy source of ULIRGs
ULIRGs may be also powered by Starburst. This can be discriminated by mid & far-IR low-resolution spectroscopy.



M. Imanishi, Spitzer GO
With Spitzer & AKARI, only a few x 10 ULIRGs at z<1 could be studied : SPICA enables us to go to z>3 !!