Tracing cosmological evolution of PAH and dust in galaxies with unbiased large spectroscopic surveys by SPICA

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SPICA (SPace Infrared telescope for Cosmology and Astrophysics) is a future mid- and far-infrared (IR) astronomy mission after AKARI, Spitzer and Herschel, with a 2.5 m telescope actively cooled down to below 8 K (Roelfsema et al. 2018). Thanks to the cryogenically-cooled telescope as well as the advanced instrument technologies, SPICA provides unprecedented high sensitivity. In particular, SPICA is extremely sensitive to broad spectral features such as dust spectral bands from faint objects, which is essential to study the properties of dust in distant galaxies. SPICA is proposed as an international project between JAXA and ESA, and very recently SPICA has been selected as one of the 3 candidates for the ESA Cosmic Vision M-class 5th mission out of the 25 proposals. SPICA will launch in the late 2020's and operate for a goal lifetime of 5 years.

With SPICA, we plan to conduct unbiased large spectroscopic surveys of galaxies in the mid-IR range which contains many spectral features associated with dust grains such as polycyclic aromatic hydrocarbons (PAHs) and silicates. These features are usually very strong compared to gas lines, and thus valuable in studying the spectral properties of faint distant galaxies. The SPICA Mid-IR Instrument (SMI; Kaneda et al. 2016, Sakon et al, 2016) is one of the two focal-plane scientific instruments aboard SPICA, which is developed by a nation-wide university consortium in Japan. SMI would trace the evolution of the dust-obscured star-formation and AGN activity in galaxies since the re-ionization epoch using the PAH and silicate features, and at the same time reveal the cosmological evolution of PAH and dust through spectral variations in the peak positions and the profiles of the dust features. For example, with a 10 deg^2 blind survey for a given observation time of 600 hours, we estimate that the SMI survey would produce as many as ~5 x 10^4 spectra of PAH galaxies at redshift z > 1 as well as ~2 x 10^4 spectra of AGN at z > 1 (Kaneda et al. 2017).

In this presentation, we show the scientific capabilities of SPICA for studies of dust in galaxies, focusing on the scientific potential of the unbiased large spectroscopic surveys with SMI, together with the latest information on the SPICA project.

References
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