An infrared spectroscopic study of silicate dust in heavily obscured AGNs with AKARI and Spitzer

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Heavily obscured active galactic nuclei (AGNs), which are surrounded by dusty AGN tori, showing almost no optical sign of AGN activities, have been found by many observational studies (e.g., [1], [2]). Many heavily obscured AGNs are known to show deep silicate absorption features (e.g., [3], [4]), which can be important spectral probes to study the AGN activity and potentially the evolutionary history of AGN tori. However detailed properties of the circumnuclear silicate dust, such as grain size, chemical composition and crystallinity, are still poorly understood. In this presentation, we show the recent result of our spectroscopic study of silicate dust in heavily obscured AGNs with AKARI and Spitzer [5].

LEDA 1712304, a nearby (z=0.0645) heavily obscured AGN, was serendipitously observed by AKARI/IRC slit-less spectroscopy. We detected a deep (τ_{sil}~2.3), broad absorption feature due to silicate grains at around 10 μm in the spectrum with a high signal-to-noise ratio. We find that the spectrum is reproduced well by a dust model consisting of a 0.1 μm-sized amorphous olivine ($Mg_{0.8}Fe_{1.2}SiO_4$) absorption feature and a hot (~500 K) dust blackbody continuum. In particular, the obscured silicate absorption feature calls for a significant porosity with 4% crystalline pyroxene. We also perform spectral energy distribution (SED) fitting to the flux densities in the UV to sub-millimeter range to investigate the global spectral properties. The resultant total IR luminosity and stellar mass are estimated to be $L_{IR}=(5\pm1)\times10^{10}$ L_{sun} and $M_{star}=(2.7\pm0.8)\times10^{9}$ M_{sun}, respectively.

In such low L_{IR} and M_{star} ranges, there are few AGNs which show that large τ_{sil}, and thus LEDA 1712304 is likely to be a rare galaxy from the aspect of having both deep absorption feature and low IR luminosity. We compare the silicate absorption feature of LEDA 1712304 with those of other AGNs observed by Spitzer/IRS (e.g., [6], [7]) which show deep (τ_{sil} >2) silicate absorption features. As a result, we find that the wing shapes of the silicate absorption profiles vary from galaxy to galaxy, although the overall shapes are notably similar despite the fact that their L_{IR} values (i.e., AGN activities) are much different by more than 2 orders of magnitude. The variations of the profiles can be explained by differences in the compositions of amorphous olivine and/or the crystallinity.

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