R17b Infrared Spectral Energy Distribution of Galaxies in their Birth

○竹内 努 (東大天文センター/NAOJ)、平下 博之 (Arcetri Obs.)、石井 貴子 (京大理天文台)

Galaxies may have been extremely metallicity poor just after their birth, and hence they may have had only a small amount of dust. In such a young galaxy, Type II supernovae (SNe II) dominates the dust formation. The size of dust formed in SNe II cannot be so large, and host galaxies are too young for grains to grow in the interstellar space. Todini & Ferrara (2001) have shown that the sizes of silicate and graphite grains to be 10 Å and 300 Å, respectively. The discrete and small sizes of grains makes the appearance of infrared spectral energy distribution (SED) of young galaxies quite different from that of nearby galaxies.

We construct a simple model of mid- to far-infrared (MIR and FIR) SEDs of galaxies to investigate the IR properties of very young galaxies based on the galaxy evolution model of Hirashita et al. (2002). Small grains cannot establish thermal equilibrium with the ambient radiation field because of their very small heat capacity. We found that, even in the intense UV radiation field of very young gaalxies, small silicate grains still cannot be in equilibrium and consequently have a broad temperature distribution. Hence, silicate grains mainly contribute to the MIR continuum emission. Graphite grains have a larger size and can be in thermal equilibrium, but the strong UV field makes their equilibrium temperature very high ($\sim$ 50–100 K), and they also contribute to the MIR. These findings encourage the observations of very young galaxies at high redshifts in the IR wavelengths. We will also present the taxonomy of galaxies by MIR and FIR color-color diagrams to pick up young galaxies from a large FIR survey expected by ASTRO-F.