Evolution of the Mass, Composition, and SED of Dust in Galaxies

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Abstract

Dust plays various important roles in galaxy evolution. First, dust grains are tiny particles of heavy elements, and they should directly re ect the evolution of galaxies. The dust grain surface works as a catalyst for molecular formation, leading to the rst burst of star formation. The stellar emission is strongly attenuated by dust, and re-emitted at mid-far infrared (M-FIR). We constructed a framework of dust evolution based on the chemical evolution (Asano et al. 2013a, b; 2014; Nozawa et al. 2015). Then we extended it to include the infall of baryons (Nagasaki et al. 2020). We also developed a radiative transfer model of galaxy spectrum based on Asano's model with a framework with a Mega-Grain approximation (Nishida et al. 2020). This provides us with a convenient set of theoretical tools to explore the dust in galaxies at any redshift from various aspects. After the advent of the next generation infrared facilities like SPICA, we will be able to tackle some fundamental and interesting problems on the dust evolution in galaxies. Since we have an evolutionary radiative transfer model, the astromineralogy of galaxies will be feasible. We will be able to decompose the dust species into several silicates and carbonaceous grains especially from the MIR spectra. We should also resolve the so-called "dust budget crisis", a problem that very young galaxies at extremely high redshifts have too much dust. We present the current status of our theoretical development on these topics.

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