Constructing the Spectral Energy Distribution Model of Galaxies Considering Dust Extinction and Re-emission

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Heavy elements are formed by nucleosynthesis in the process of stellar evolution, and significant fractions of them are emitted to interstellar space as dust grains. Dust grains scatter and absorb ultraviolet (UV) and optical emission from stars, and re-emit at infrared (IR). This process prevents us from directly observing stellar light from galaxies. To understand the intrinsic properties of galaxies, we must take into account both of dust extinction and re-emission.

In this study, we construct a consistent spectral energy distribution (SED) model with chemical evolution of galaxies by considering the dust extinction and re-emission. We adopt an evolutionary synthesis code "PEGASE" (Fioc & Rocca-Volmerage 1997) to get stellar spectra of galaxies. We used extinction curves of Calzetti et al. (2002), Cardelli et al. (1989) and Pei (1992), and employ Dale & Helou (2002) for dust re-emission spectra.

We calculated the evolution of the SEDs of galaxies for various cases. These results lead us to three conclusions. First, these SEDs have similar shapes and they behave similarly with time. Second, galaxies can be observed as luminous IR galaxies when galactic age is about from 500 Myr to 1 Gyr because dust re-emission is most enhanced at this age. Finally, luminous galaxies at optical now were bright at IR in previous times.

By using this model we can determine metallicity in galaxies as a function of galactic age and calculate the dust extinction and re-emission consistently with metallicity. We can estimate star formation rate, metallicity, dust abundance and other important quantities of high-z galaxies by fitting this model to SEDs gotten from high-z observations.