

Evolution of dust extinction curves in galaxy simulation

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Dust plays an essential role in galaxy evolution through dust extinction, emission, and dust surface chemical reactions. In order to understand the dust enrichment in galaxies, we developed a dust evolution model and implemented it in our code, `GADGET3-Osaka`, and calculated the evolution of dust in each SPH particle. In this code, non-equilibrium cooling is treated with the Grackle chemistry package including molecular hydrogen cooling. For the grain size distribution, we treat small and large grains separately. The following processes are included for dust evolution: dust production, destruction and feedback of type Ia and II supernovae and AGB stars, dust growth in molecular clouds, and grain disruption by shattering in the diffuse interstellar medium.

In this presentation, we consider the dust whose species are separated into carbonaceous dust and astronomical silicate in an isolated galaxy whose mass is almost same as the Milky Way. We investigated the dependence of extinction curves on the position, gas density, and metallicity in the galaxy. The 2175 Å bump and far-ultraviolet (FUV) rise become significant after dust growth by accretion. At $t \gtrsim 3$ Gyr, extinction curves show a very strong 2175Å bump and steep FUV rise because shattering works efficiently in the outer disc and low density regions. We included the necessary dust processes in the model so successfully that the extinction curves at $t \gtrsim 3$ Gyr are consistent with the Milky Way extinction curve. In addition, we found that the outer disc component caused by stellar feedback has an extinction curves with a weaker 2175 Å bump and after FUV slope. On the other hand, our simulation results tend to underproduce the FUV rise in the Small Magellanic Cloud extinction curve due to the strong contribution of carbonaceous dust.