Evolution of the extinction curves in galaxies

R. S. Asano[1] , T. T. Takeuchi[1] , H. Hirashita[2] , and T. Nozawa[3]

[1]*Nagoya University*

[2]*Academia Sinica Institute for Astronomy and Astrophysics*

[3]*Kavli IPMU*

Dust grains absorb or scatter the stellar light (called extinction), in particular, shorter wavelength like ultraviolet and re-emit the thermal emission as far-infrared. Thus, the understanding of dust grains is necessary for getting the information of galaxies from observation accurately. Also, the effect of extinction depends strongly on the size distribution, amount, and species of grains. We construct an evolution model of the extinction curves based on the theoretical model for the evolution of grain size distribution we constructed before and investigate the evolution of the extinction curves in galaxies.

In the first stage of the galaxy evolution, supernovae mainly produce dust grains. Since these dust grains are relatively large, the extinction curves become flat. As the galaxy evolution proceeds, since the effect of shattering becomes large, the number of small grains (< 0.01 μ m) increases. Further, the small grains grow due to the metal accretion onto the grains. Consequently, the number of dust grains with the radius of ~ 0.01 μ m becomes large, the extinction curves become steep. And, we found that the bump of 2175Å becomes large at the same time.

After the coagulation becomes effective, the extinction curves become flatter and approaches the extinction curve of the Milky Way. However, compared with the extinction curve of the Milky Way, the predicted extinction at wavelength 0.1 μ m is larger.

There are three solutions of the problem as follows: (1) neglect the effect of the metal accretion, (2) neglect the shattering of silicate dust (3) introduction of larger contribution of coagulation. Among the three solutions, since the evolution of dust mass cannot be explained in the solutions of (1) and (2), (3) looks the most plausible solution, i.e., the effect of coagulation may be larger than we have considered that of coagulation.