A New Dust Evolution Model in Galaxies with Gas Infall

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Dust is a tiny solid particle that influences the physical properties of galaxies, depending on the size distribution or quantity of dust. Thus, proper understanding of dust evolution is fundamentally important to understand the formation and evolution of galaxies.

Dust is provided by AGB stars and supernovae. After that It grows in the ISM. On the other hand, dust also experience the destruction by supernova shock. Furthermore Dust change the size distribution because of the shuttering and coagulation.Asano et al. (2013a, b, 2014) proposed a comprehensive theoretical model (hereafter Asano model) which consistently solves the chemical evolution of dust in galaxies, based on the assumption of the closed box model. Recently, galaxies with a large amount of dust have been discovered at very high redshifts. To explain the dust amount in these galaxies, it is necessary to supply a huge amount of dust at a very early stage in galaxy evolution where only a moderate stellar mass has accumulated. According to the Asano model, dust accretion in the dense interstellar matter is found to be crucial. However there remains some problems that have not been sufficiently explained yet.

In this study, we developed a new version of the Asano model, implementing the inflow of gas from intergalactic space. Nowadays the inflow is regarded as one of the basic processes in galaxy evolution. We found that even if the gas is significantly consumed to form stars, dust can grow in the interstellar matter infalling from outside of a galaxy. This can supply sufficient amount of dust at a young galaxy age when the stellar mass is quite small.