

Dust formation history of galaxies: The crucial role of metallicity for the grain growth

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Dust enrichment in galaxies is crucial to understand the evolutionary properties of galaxies, like observed spectrum of galaxies and so on. We investigate what kind of dust production process is dominant at each stage of galaxy evolution. We consider asymptotic giant branch (AGB) stars, type II supernovae (SNe II) and the grain growth in the interstellar medium (ISM) as the source of dust, SN shocks as the destruction mechanism of dust. With these ingredients, we construct a galaxy evolution model by taking into account the age and metallicity dependence of the source of dust.

We find that although SN II is the main source of dust at early stage of galaxy, the contribution of AGB stars catches up that of SNe II at several 10^8 yr. After the grain growth in the ISM becomes dominant, the dust mass increases rapidly and becomes more than two orders of magnitude larger than the case without the ISM grain growth. Further, we found that onset time of the grain growth in the ISM depends on not galactic age but metallicity.

We compare our results of calculation to observed data of nearby galaxies and distant dusty QSOs (only total dust mass $> 10^8 M_\odot$). As for nearby galaxies, we find that most of dust amount in these galaxies may be originated from the grain growth. As for distant QSOs, their huge dust amount can also be explained by the grain growth. Further, we will discuss the effect of the grain size distribution.