Dust Processing in the Interstellar Medium

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In considering the evolution of dust in the interstellar medium (ISM), there are two aspects to be considered: the dust amount and the dust properties. After reviewing various dust formation and destruction processes that affect these two aspects, we focus on dust processing in the ISM: (i) grain growth by the accretion of gas-phase metals; (ii) grain growth by coagulation; (iii) shattering (grain disruption/fragmentation); and (iv) dust destruction by supernova shocks. We put particular emphasis on (i) and (iii), which are also related to (ii) and (iv) as follows. (i) Grain growth is the major mechanism that drives the dust mass increase in metal-enriched systems. The dust-composing materials are returned to gas phase by (iv). (iii) Shattering is the unique efficient production mechanism of small grains. Large grains produced by (ii) are effectively fragmented into small grains by shattering in the diffuse medium. We also emphasize that (i) and (iii) are not independent. These are strongly entangled and affect both the grain size distribution and the total dust mass. Therefore, in order to understand the evolution of dust over the entire galaxy evolution, we should consider not only the dust production and destruction by stellar sources, but also all those interstellar processes consistently. Some examples of incorporating these processes into galaxy evolution models are also shown.