X70a Effective Dust Yields from Supernovae and Implications for Extinction Properties

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Understanding the physical properties of dust in galaxies is important for galaxy formation and evolution. As the origin of dust in the early Universe, core-collapse supernovae (SNe) are considered the dominant source of dust enrichment. The reverse shock generated by the interaction between the interstellar medium (ISM) and the SN forward shock can significantly reduce the mass of newly formed dust, although there is still uncertainty on the destructive effect. Here, we calculate the dust mass, composition, and grain size distribution after the passage of the reverse shock using the `GRASHrev` model. Our analysis covers a large grid of SN models with progenitor masses (13–120 $M_{\odot}$), initial metallicity ($-3 \leq$ [Fe/H] ≤ 0), and rotation velocities (0 and 300 $\mathrm{km\,s^{-1}}$). The SN explosions are assumed to occur in a uniform ISM with 0.05, 0.5, and 5 $\mathrm{cm^{-3}}$. We find that the larger grains ($\gtrsim 10\,\mathrm{nm}$) are more resistant to destruction by the reverse shock, with amorphous carbon dominating the surviving dust mass. For non-rotating progenitors, the maximum surviving mass is $\simeq 0.02\,M_{\odot}$ released by SN explosions of a 120 $M_{\odot}$ progenitor with [Fe/H] $= 0$ in the ISM density of 0.5 $\mathrm{cm^{-3}}$, corresponding to $\simeq 4\%$ of the dust mass before the passage of the reverse shock. In this talk, we will introduce our model and compare the effect of reverse shock on the grain size distribution. Furthermore, based on our results, we will discuss the UV extinction bump at 2175 Å in high-redshift ($z > 6$) galaxies recently observed by the JWST.