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Shock-induced formation and survival of dust in the dense CSM surrounding Type IIn supernovae

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The light curve of Type IIn supernovae are dominated by the radiative energy release through the interaction of the supernova blastwave with their dense circumstellar medium (CSM). Specifically, in case of ultraluminous Type IIn supernova SN 2010jl, the spectra show an excess in the IR component as early as a few weeks after the explosion. The IR emission has been attributed by some as evidence for early dust formation in the circumstellar gas. We investigate in detail the physical processes that may inhibit or facilitate the formation of dust in the CSM. The post-explosion environment of Type IIn supernovae are characterized by high velocity shocks and strong ionizing radiations. We show that dust formation is inhibited by the effect of the downstream radiation from the supernova forward shock. In spite of the high densities in shocked gas that ensue rapid cooling, we find that the formation of dust grains in the post-shock circumstellar shell of SN 2010jl does not commence until day 380 post- explosion. On the other hand, observations on day 460 and later show that the IR luminosity exceeds the UV-optical luminosity. The IR emission is therefore powered by the UVO emission from the reverse shock which is totally absorbed by the optically-thick shell of newly-formed CSM dust. The early IR emission is attributed to an IR echo from preexisting CSM dust, which has survived the SN flash associated with the outburst. In this talk, I shall present the first model of Type IIn supernovae that addresses the role of the radiation from the SN forward and reverse shock in the formation and survival of dust in the dense circumstellar environments.

Consider for a poster?

Yes

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