Cold dust emission from the shocked material around supernova remnants

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Abstract

Dust destruction in shocks driven by supernovae is thought to be the dominant process removing dust from the interstellar medium. The efficiency of this process can be calculated from theoretical models or estimated from observations of supernova remnants (SNRs), but in both cases the shocked material is often assumed to be homogenous. We determine the properties of the shocked gas in three SNRs from X-ray data, and show that emission from dust grains heated collisionally by this gas is unable to fit the full infrared spectral energy distributions, as the grain temperatures are too high. A colder dust component is required, which for reasonable assumptions about the heating mechanism makes up close to 100% of the total swept-up dust mass. This cold dust is most likely associated with the warm gas seen in molecular emission in some SNRs, in which case it can plausibly survive the evolution of the shock without any significant destruction. Timescales for dust removal based on homogenous models of shock evolution may be seriously overestimating the efficiency of dust destruction in the interstellar medium, with implications for our understanding of dust production mechanisms.

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