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When does dust form in supernova remnants?

The discovery of 0.4-0.7$M_\odot$ of dust in the remnant of SN1987A 23 years after its explosion (Matsuura et al. 2011) demonstrated that supernovae can be efficient dust factories, but raised many questions. Among them, when did this dust form? Was it there at early times but previously undiagnosed by techniques for estimating dust masses, or did it form at later times? In Wesson et al. (2015) we created radiative transfer models to investigate this question, fitting the optical-far IR SED of SN1987A to calculate the dust mass at epochs from 600-9000 days after the explosion. We found that the rate of dust formation could be represented by a sigmoid curve with peak dust formation occurring many years after the explosion.

The far infrared observations necessary to constrain the emission from cold dust are lacking in most supernovae. An alternative method of estimating the dust mass exploits the blue-shifting of emission lines in the presence of dust to diagnose the dust mass. We have obtained optical-near IR spectra of supernova remnants of ages from 5-50 years with X-SHOOTER at the VLT. Broad emission lines are detected in a number of remnants, and we have used the radiative transfer code DAMOCLES (Bevan and Barlow, 2016) to calculate dust masses, to investigate the general pattern of dust formation with remnant age.