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Investigating the X-ray Emission from high X-ray Luminosity Supernovae

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Type IIn supernovae (SNe) are characterized by narrow lines on a broad base in their optical spectrum. A wide diversity in their lightcurves, and in SNe that exhibit IIn features, has greatly complicated the task of identifying their progenitors. IIns have the highest X-ray luminosity of all SN classes, and are observable in X-rays decades after explosion. Many of the lightcurves tend to fall off rather steeply at late times, although one interesting case displayed a rising light curve for several thousand days. These characteristics, along with their high luminosities at other wavelengths, imply initial expansion in a very dense medium in most cases. At later times the densities decrease faster than expected for expansion in a steady wind. Their X-ray spectra generally show distinct lines, suggesting that the emission is thermal in origin.
A recent exciting entry to the category of X-ray SN was the discovery by our group of a Type Ia-CSM, SN 2012ca, the first Type Ia SN of any kind to be detected in X-rays. Our best fit model for the X-ray emission from SN 2012ca suggests that it is expanding into a 2-component medium, with a number density around 10^8 cm^{-3} for the higher density component. Although the nature of these objects is unknown, we show that the X-ray properties of SN 2012ca are very similar to those of many Type IIn SNe.
We have compiled a database of lightcurves of most young SNe that have been detected in X-rays. Currently we have over 60 SNe spanning all the various types, but the database is expanding rapidly. The lightcurves themselves span 12 orders of magnitude in luminosity. We will show the X-ray lightcurves of IIns and the single Type Ia-CSM, compare their lightcurves and spectra to those of other types of SNe, as well as to data at other wavelengths. We will review the known properties of the X-ray emission from Type IIn, and explore the implications for the SN environment, progenitor mass-loss and the identity of the progenitors.

Topic

Compact and diffuse sources in galaxies and in the Galactic Center

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