SWIFT XRT OBSERVATIONS OF CORE COLLAPSE SUPERNOVAE

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We have analyzed the X-ray data from Swift XRT for the core collapse supernovae 2005cs (Type II), 2006jd (Type IIb), 2008ax (Type IIp), 2008ij (Type II), and 2009dd (Type II). From the data, we have calculated the X-ray light curve as well as the circumstellar matter density about the progenitor and the mass loss rate of the progenitor.

Analysis was done using *ximage* software. The supernovae were included in regions with radius of 5 pixels about the position of the SN. Background regions were created as appropriate.

Methods

In order to accomplish these results, we used the XRT images from the Swift telescope. For each of the SNe included, the images were stacked into several epochs of several images each. These epochs were chosen so that the x-ray emission from the SN was clearly observable. Each epoch was then analyzed using the *ximage* software package to determine the count rate. These count rates were converted into flux rates using the online *pimms* software available from the Swift website.

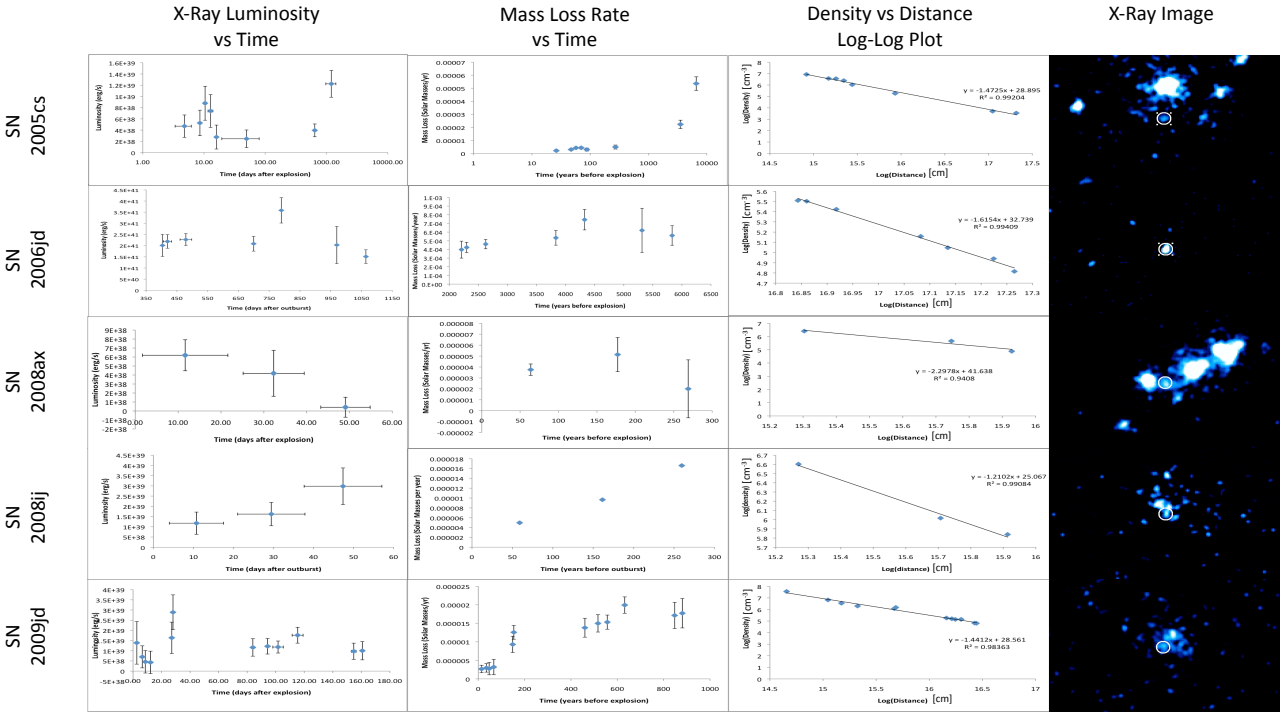
The Luminosity was determined using the equation:

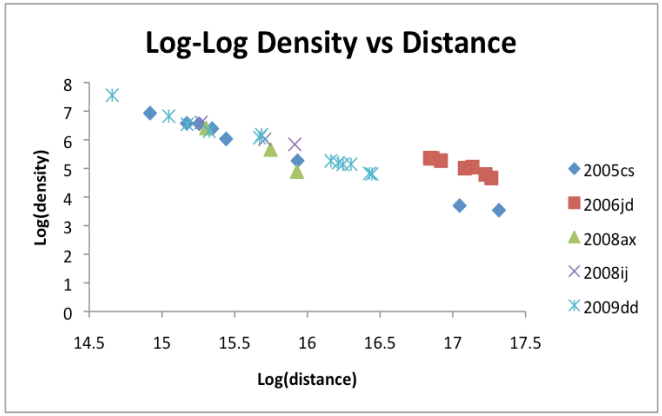
$$L_x = 4\pi \cdot d^2 \cdot f$$

where d is the distance and f is the flux determined using pimms online software. Densities were determined using the following equation:

$$\rho = \frac{1}{8}\sqrt{\frac{L_x}{\Lambda \cdot \pi \cdot (v_s \cdot t)^3}}$$

where Λ is the cooling function ($\Lambda \approx 5.66 \times 10^{-23}$ erg•cm^3/s), v_s is the shock speed, and t is the time after outburst.[1] We assumed an average mass of 1.8×10^{-27} kg for H+He plasma (90% H, 10% He). Distance from the SN progenitor was determined assuming a stellar wind speed of 10 km/s and assuming a shock speed of 20000 km/s.[2]





Results/Conclusions

As can be seen in the plots, we obtain very similar slopes for the log-log Density vs Distance plot, although we have a number of different types of SNe included in this study. This plot leads to a density profile of

$$\rho \propto r^{-1.5}$$

We also obtained light curves and mass-loss rates[3] for the SN and progenitor (respectively).

[1] R Chevalier and C Fransson, *Supernovae and Gamma-Ray Bursters*, K Weiler (Ed) 171 (2001)
[2] C Fransson and P Lundqvist, *ApJ* **461** 993-1008 (1996)
[3] R A Chevalier, *ApJ* **259** 302-310 (1982)