APR08-2008-001181

Abstract for an Invited Paper
for the APR08 Meeting of
the American Physical Society

Observations of Supernovae during and after Shock Breakout

STEFAN IMMLER, NASA Goddard Space Flight Center

Supernovae (SNe) are some of the most energetic explosion since the birth of the universe. Over the past few years, space-based observatories have allowed detailed studies of these energetic events in previously unexplored wavelength regimes. NASA's *Swift* observatory is particularly suited to probe the early emission of SNe due to its fast response, flexible scheduling capabilities, and large wavelength band coverage, ranging from the optical, UV, and X-ray to the Gamma-ray bands. By studying the outgoing SN shocks with material in its surroundings, the explosion physics and nature of progenitor stars can be studied. Furthermore, monitoring the X-ray emission of SNe with space-based X-ray observatories is being used to map the density structure in SN environments out to large radii from the sites of the explosions ($>10^{20}$ cm, 10,000 times larger than our solar system), the transition of a SN into an old supernova remnant can be studied, and the mass-loss rates of the progenitor stars can be probed over significant timescales ($>10^4$ years) in the stellar wind history. In combination, these observations give unprecedented insights into the nature of energetic explosions and their environments. During this talk, I will present highlights from recent observations, among them the first observation of a SN *during* the actual explosion with *Swift*.