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Supernova 2023ixf in M101

Monday, 11 December 2023 16:10 (20 minutes)

I will give an introduction of our studies on a recent type II supernova (SN 2023ixf) exploded in nearby galaxy M 101 at a distance of 6.85 Mpc. Such a close distance makes SN 2023ixf a nearby, bright stellar explosion that appears once in a decade, providing a rare opportunity to study the pre-explosion evolution of massive star and view the moment of shock breakout from the progenitor. Our instant multiwavelength observations, starting at ~ 1 hour after the explosion, reveal the shockwave pulse breaking out of a red supergiant (RSG) with a size of 450 solar radius and the shock propagation in an optically-thick dusty circumstellar shell. The earlytime light curves favor that the breakout and perhaps the distribution of the surrounding dust were not spherically symmetric. Analysis of the pre-discovery images (obtained 20 years before the SN explosion) indicate that SN 2023ixf originated from a RSG star with an initial mass of 11-14 M_{\odot} . The derived mass loss rate is much lower than that inferred from the flash spectroscopy of the SN, suggesting that the progenitor experienced a sudden increase in mass loss when approaching the final explosion. Combining with early-time polarization observation, such a violent mass loss is likely a result of binary interaction.

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