

## **Asymmetry deciphered in supernova interaction with stellar environment can provide clues about their structure & chemistry**

A supernova explosion tracked over two years, have helped scientists decipher the asymmetry of the giant stellar explosions and how they interact with the stellar environment around it. It will help them delve into these mysterious objects which are till now largely understood theoretically.

Supernovae (SNe) explosions outshines the entire galaxy. They burn for only a short period of time, but can tell scientists a lot about the universe. They also play a key role in distributing elements throughout the universe. Recent observational studies of these powerful luminous stellar explosions have indicated asymmetry of structure as against theoretical studies which earlier indicated that supernova explosions are symmetrical in geometry. However, efforts to study such asymmetries have lagged behind because of dedicated long term follow up campaigns and availability of larger diameter telescopes at the right time.

A long term observational campaign of a particular class of Supernova – the type IIc SN 2012ab, by the researchers of Aryabhata Research Institute of observational sciences (ARIES), Nainital, an autonomous institute under Department of Science and Technology (DST), Government of India has confirmed the asymmetry and also revealed that the asymmetry increases when the ejecta interacts with the stellar environment around it called the circumstellar environment (CSM).

The detailed analysis of this geometry carried out by a Ph. D. student Anjasha Gangopadhyay has been accepted for publication in the journal *Monthly Notices of the Royal Astronomical Society*. This research also involved a large international collaboration from Istituto Nazionale Di Astrofisica (National Institute for Astrophysics) located in Padova, Italy.

This is one of the few cases where the geometry of the supernova explosion with the circumstellar medium has been explored with multiple telescopes and the expertise of highly acclaimed international collaborators also helped decipher the physical properties and associated asymmetry in SN 2012ab. It helped to delve into the explosion of an interacting SNe which leads a bubble of gas expanding at very high velocity that interacts with the CSM leading to an enormous rebrightening near the supernova location. The analysis of the geometry helped probe the supernova symmetry and the chemical aftermath of its explosion.

The ARIES scientists said that the aftermath of an explosion followed by interaction is highly asymmetric and diverse. The geometry may be spherical, non-spherical or

disk like. Long term follow up campaigns of the interacting SNe group will help in deciphering the diverse but least explored scenario of SN explosions.

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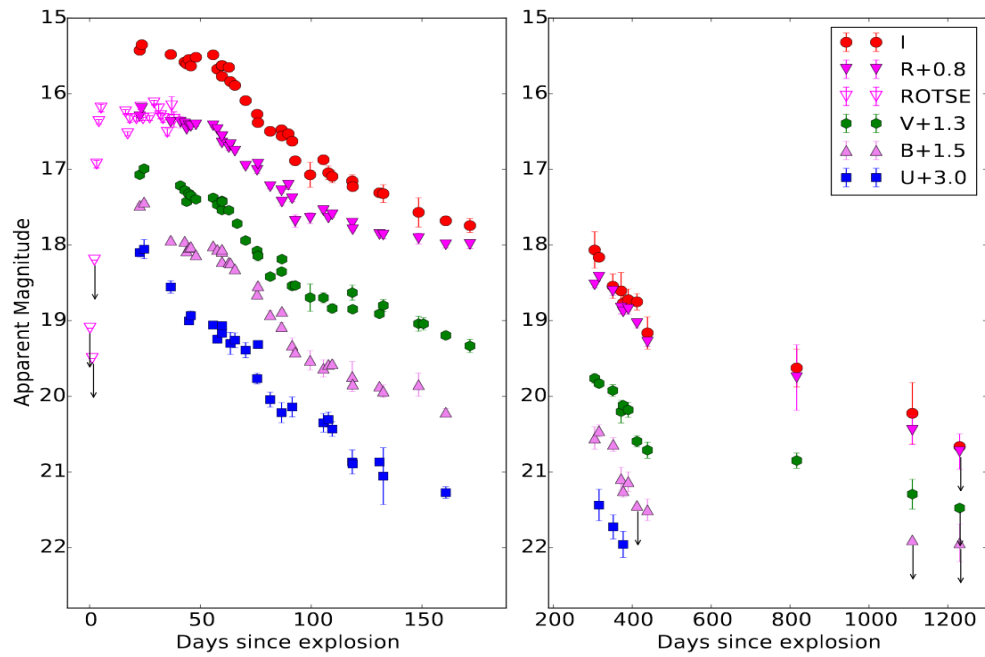


Figure 1: The long term multi stage temporal evolution of SN 2012ab with a late time flattening due to CSM interaction

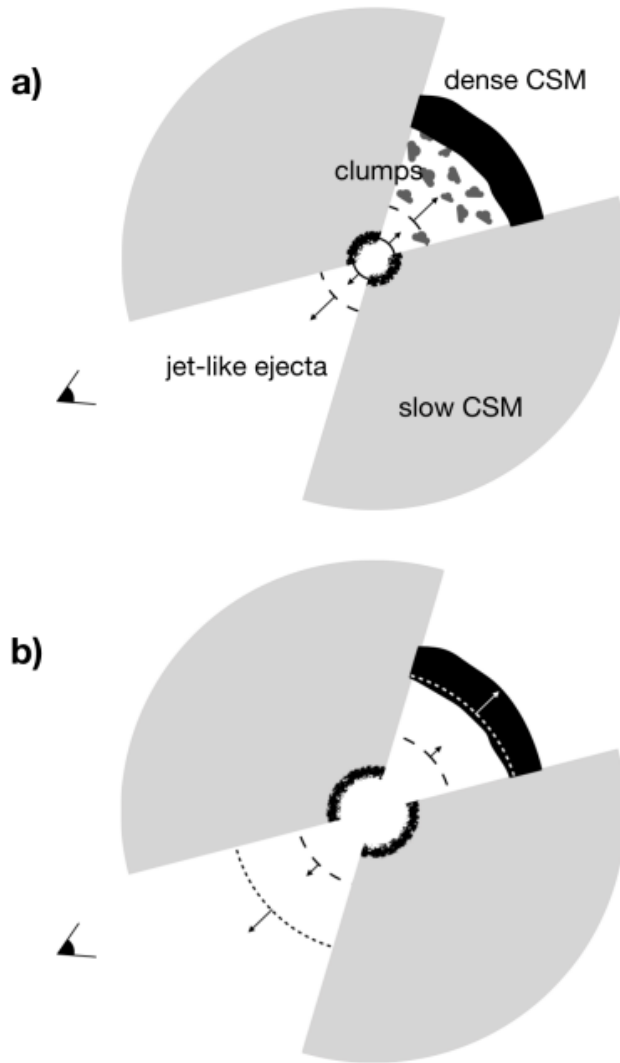


Figure 2: Sketch of the configuration of SN 2012ab and its CSM at about (a) 40 d and about (b) 80 d past explosion. The observer is placed in the bottom left corner of both panels.

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