Title

Radio Observations of Relativistic Supernova

Abstract

We propose a radio monitoring program to study the radio emission from Type Ic broad-lines supernovae (Ic-BL SNe). These energetic explosions require the presence of an additional central engine to explain their large kinetic energy: the rapidly rotating compact remnant, formed in the collapse of the massive star, can power a collimated jet that propagates within the progenitor·s stellar layers, also giving rise to a cocoon spreading laterally, with important consequences on the synthesis of Fe-peak elements and kinematics of the SN ejecta. If the central engine operates for a sufficiently long time, the collimated component will successfully escape the dense stellar environment giving rise to a gamma-ray burst, otherwise, the jet will choke inside the progenitor star, depositing all its energy into the cocoon. After break-out, the cocoon expands with a mildly relativistic velocity (v~0.1c), emitting radio frequencies soon after the explosion. However, jets propagating at large angles from the observer direction can show an off-axis afterglow component a few weeks/months (depending on the angle) after the core collapse. A monitoring program of Ic-BL SNe at radio frequencies with MeerKAT will allow us to detect nearby Ic-BL SNe at radio frequencies, and characterize the evolution of the spectral properties below and above the self-absorption break frequency along the entire duration of the SN, thanks to the high sensitivity of MeerKAT in the 0.9 - 3.5 GHz frequency range. This will allow us to quantify the physical properties of the jet/cocoon in powering the relativistic supernova.