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PARTICLE ACCELERATION IN SUPERNOVA REMNANT EXPANDING INSIDE WIND-BLOWN BUBBLE

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Context. Supernova Remnants (SNRs) are considered as the primary sources of galactic cosmic rays (CRs), where CRs are assumed to be accelerated by diffusive shock acceleration (DSA) mechanism, specifically at SNR shocks. The SNR shocks expand in the complex ambient environment, particularly in the core-collapse scenarios as the core-collapse SNRs evolve inside wind-blown bubbles created by the mass-loss of massive stars during their different evolutionary stages. Therefore, the evolution of core-collapse SNRs, as well as cosmic ray acceleration is expected to be considerably different from SNR evolution in a uniform environment.
Aims. The aim is to observe the influence of different ambient medium of core-collapse SNR shock on the particle spectra. Furthermore, the interactions of SNR shock with fluctuations in density within the wind-blown bubble generate several transmitted and reflected shocks. So, the impact of SNR shock interactions with different discontinuities, on particle spectra, and finally the effect on emission from the remnant are also the areas of focus.
Methods. The hydrodynamic structures of wind-blown bubbles at pre-supernova stages formed by $20M_{\odot}$, $35M_{\odot}$, and $60M_{\odot}$ stars have been used to create the ambient environment for supernova explosion. Stars, with those particular masses, evolve through different stages from Zero Age Main Sequence (ZAMS) to the pre-supernova stage, therefore the wind bubbles formed by them should be structurally different. Then, the transport equation for cosmic rays, and the hydrodynamic equations have been solved simultaneously in 1-D spherical symmetry.
Result. Evolution of core-collapse SNRs inside complex wind-blown bubbles, modifies the particle spectra and emission from the remnant.

Keywords

Supernova Remnants; Wind-Blown Bubbles; Hydrodynamics; Cosmic Rays

Collaboration

other Collaboration

Subcategory

Theoretical Results

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