Contribution ID: **88** Type: **oral**

On the spectral softening in core-collapse supernova remnant expanding inside the wind bubble

Wednesday, 27 October 2021 15:40 (20 minutes)

Context. Supernova Remnants (SNRs) are considered as the primary sources of galactic cosmic rays (CRs), accelerated by diffusive shock acceleration (DSA) mechanism at SNR shocks. The core-collapse SNRs expand in the complex ambient environment, 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.

Aim. The impact of SNR shock interactions with different discontinuities and circumstellar magnetic field present in the wind bubbles on particle spectra, and emission morphology from the remnant are the areas of our focus.

Methods. Supernova explosion has been injected inside the wind-blown bubble at the pre-supernova stage formed by a massive star. Then, the transport equation for cosmic rays, hydrodynamic equations, and magnetic field induction equation have been solved simultaneously in 1-D spherical symmetry.

Result. We have acquired softer particle spectra with spectral index close to 2.5 during the propagation of supernova shock inside the shocked wind. Additionally, the magnetic field structure significantly influences the emission morphology from the remnant.

Please choose the session this abstract belongs to

Cosmic rays

Summary

We present our contribution about the determination of the **spectral softening** arising from the supernova remnant shock propagating through the **very hot shocked wind material** in the **core-collapse scenario**.

- **sub-shock compression ratio for forward shock** diverges from **4 and reaches about 1.5** as **the sonic Mach number of forward shock decreases** during its evolution through **the hot material**.
- When the forward shock interacts with the hot wind bubble, we have obtained **persistent softer particle spectra with spectral index close to 2.5** beyond free wind region between **the energy range $0.3\mathrm{GeV} - 10\mathrm{TeV}$**.
- **The CSM magnetic field has a significant impact on the emission morphology**.

Primary author: Ms DAS, Samata (DESY, Institute of Physics and Astronomy, University of Potsdam, Germany)

Co-authors: Mr MEYER, Dominique M.-A. (Institute of Physics and Astronomy, University of Potsdam, Germany); Mr SUSHCH, Iurii (Centre for Space Research, North-West University, South Africa and Astronomical Observatory of Ivan Franko National University of L’viv, vul. Kyryla i Methodia, Ukraine); POHL, Martin (D); Mr BROSE, Robert (Dublin Institute for Advanced Studies, 31 Fitzwilliam Place, Dublin 2, Ireland)

Presenter: Ms DAS, Samata (DESY, Institute of Physics and Astronomy, University of Potsdam, Germany)

Session Classification: Session 3