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Precessing Jets in Supernovae Shells

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Supernovae (SN) and astrophysical jets are two of the most energetic and intriguing objects in the universe. We examine an interesting scenario that involves the interaction of these two extreme phenomena, uniquely ''combined" in the W50-SS433 system: a jet launched from the microquasar SS433 (an X-ray binary, XRB) located inside a supernova remnant (SNR), W50. Observations have revealed a unique morphology of the remnant, attributed to the presence of the jet. The jet penetrates the shell and alters its quasi-spherical shape, leading to an elongated shape parallel to the mean jet axis - which is frequently mentioned as a "manatee" shape.

We perform full 3D relativistic hydrodynamic simulations to better resolve the interaction between the supernova remnant and the jet. These simulations capture both the initial supernova blast (non-relativistic regime) and the subsequent evolution of the jet (relativistic regime). The first part of our project is to analyze the propagation of the jet inside the shell, the resulting shape of the nebula and the effect of the density profile of the ambient medium. The precession of the jet in SS433 is also taken into account, testing different scenarios.

The second, complementary part of this project, is the creation of emission maps by post-processing the simulation data with a radiation transfer code. Synchrotron emission is a common choice, assuming equipartition to compensate for the hydro nature of the simulations, but other emission regimes can also be considered.

Contribution

Talk

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