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Turbulent magnetic field and high-energy emissions from young supernova remnants

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Supernova remnants (SNRs) are astronomically very interesting objects because they are the sites of cosmic-ray acceleration that cause multi-wavelength emissions through various non-thermal processes [1-3]. SNRs are formed by shock sweep up of the ISM. However, the effects of realistic ISM inhomogeneity on the dynamics of SNRs have not studied very well. In this poster, based on MHD simulations, I show that interaction between realistic inhomogeneous ISM and supernova shock wave cause many interesting effects such as short time variability of x-rays, spectral modification of gamma-ray emission, polarization angle shift and so on [4-11]. I also show the recent results of MHD plus cosmic-ray streaming simulations aiming to predict the realistic gamma-ray spectrum of the young SNRs. We find that cosmic-ray streaming instability induces small-scale Alfven waves that significantly reduce diffusion coefficient of cosmic rays and modifies gamma-ray spectrum as observed by the Fermi space telescope.

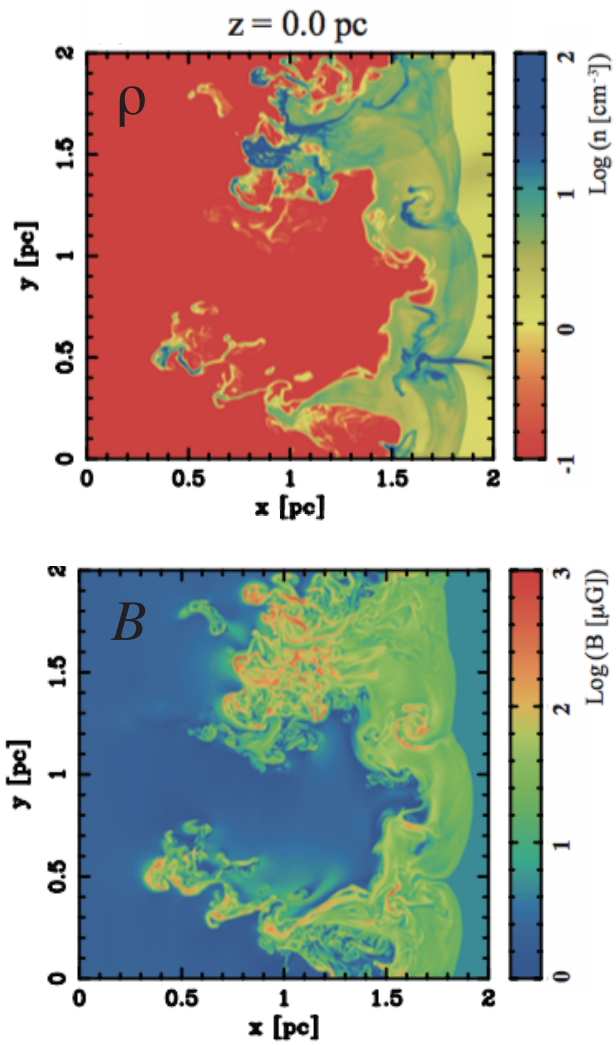

Figure 1: 2D slices of the density and magnetic field structures that are created behind a realistic SNR shock wave.

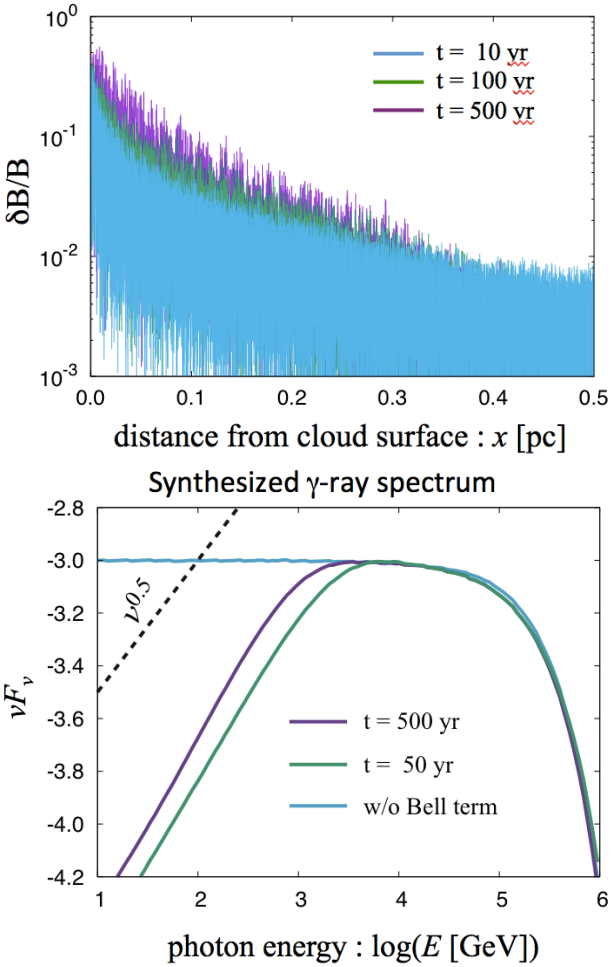

Figure 2: magnetic field structure induced by cosmic ray streaming instability (top) and synthesized gamma-ray spectrum from realistic SNR interacting with clouds.

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