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Study on The Difference Between Proper-Motion of Balmer hydrogen line emission and Non-Thermal X-Ray emission in SNRs

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Balmer line emission (Hα) by neutral hydrogen and X-ray synchrotron emission by accelerated electrons are observed from some supernova remnants (SNRs), which are thought as accelerators of galactic cosmic rays (CRs). From these observations, the cosmic ray acceleration eciency is estimated. According to the theory of diusive shock acceleration (DSA), electrons are accelerated around the shock front, and emit the synchrotron radiation. Measurement of proper motion of the synchrotron X-rays gives the shock velocity. At the same time, we can estimate the post shock temperature from the line width of Hα emission, because neutral hydrogen collide with downstream hot protons and exchange their charge, so that the hot neutral component arises.

In the specific case of a SNR RCW86, measured expansion speed of Hα filament is about 1200km/s(Helder et al. 2013), while 6000km/s in X-rays (Helder et al. 2009). It is expected that the emission regions of the Hα and the synchrotron X-rays are dierent. However, they are overlaid in the same line of sight.

In this study, using three dimensional magnetohydrodynamics (MHD) simulations, we consider propagation of super

nova blast wave shock in realistic inhomogeneous interstellar medium. Interaction between the upstream density inhomogeneity and the shock wave causes rippled shock structure and uctuation of local shock velocity. We show that our synthetic observations of the MHD simulation data are consistent with actual observation results for RCW86.

Keywords: supernova remnants, shock wave, cosmic ray