The Effect of Circumstellar Medium on Cosmic Ray Acceleration in Type Ia Supernovae

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Abstract

We present our results on the range and time evolution of the maximum energy that charged particles can obtain while they are accelerated in the forward shock of Supernova Remnants resulting by Type Ia Supernovae (SNe Ia). In particular, based on semi-analytical and numerical descriptions, we investigate the dynamics of a Supernova Remnant evolving in a modified ambient medium formed by the mass outflows of the progenitor system. We associate the ambient medium properties to the suggested diversity of SNe Ia progenitors and we study the effects of such an evolution on the acceleration of cosmic rays. We find that the range and the time evolution of the cosmic rays' maximum energy are strongly dependent on the ambient medium properties. Thus, combining this result with the predictions of SNe Ia population synthesis, we conclude that the modification of the ambient medium by the SN Ia progenitors cannot be neglected in the study on the origin of galactic cosmic rays.