

Abstract Submitted
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Collective Escape of Cosmic Rays from their Acceleration Sites¹

MIKHAIL MALKOV, PATRICK DIAMOND, UCSD, ROALD SAGDEEV, University of Maryland, FELIX AHARONIAN, DIAS, MPIK Heidelberg, IGOR MOSKALENKO, HEPL, SLAC, Stanford — Supernova remnant (SNR), as the major contributors to the galactic cosmic rays (CR), are believed to maintain an average CR spectrum by diffusive shock acceleration (DSA) regardless of the way they release CRs into the interstellar medium (ISM). However, the interactions of the CRs with nearby gas clouds crucially depend on the release mechanism. Recently, such interactions have been actively studied by observations in the gamma-ray band to probe the SNR as a particle accelerator. Motivated by these observations, we call into question two aspects of a popular paradigm of the CR injection into the ISM, according to which they passively and isotropically diffuse in the prescribed magnetic fluctuations as test particles. First, we treat the escaping CR and the Alfvén waves excited by them on an equal footing. Second, we adopt field aligned CR escape outside the source, where the waves become weak. An exact analytic self-similar solution for a CR “cloud” released by a dimmed accelerator will be presented. The observational consequences of this solution will be discussed.

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