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The Gamma Ray Origin in RX J0852.0-4622 Quantifying the Hadronic and Leptonic Components: Further Evidence for the Cosmic Ray Acceleration in Young Shell-type SNRs

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Fukui et al. quantified the hadronic and leptonic gamma-rays in the young TeV gamma-ray shell-type supernova remnant (SNR) RX J1713.7−3946 (RX J1713), and demonstrated that gamma rays are a combination of hadronic and leptonic gamma-ray components with a ratio of ∼6:4 in gamma-ray counts Ng. This discovery, which adopted a new methodology of multi-linear gamma-ray decomposition, was the first quantification of the two gamma-ray components. In the present work, we applied the same methodology to another TeV gamma-ray shell-type SNR RX J0852.0−4622 (RX J0852) in 3D space characterized by (the interstellar proton column density Np)-(the nonthermal X-ray count Nx)-[Ng], and quantified the hadronic and leptonic gamma-ray components as having a ratio of ∼5:5 in Ng. The present work adopted the fitting of two/three flat planes in 3D space instead of a single flat plane, which allowed suppression of the fitting errors. This quantification indicates that hadronic and leptonic gamma-rays are of the same order of magnitude in these two core-collapse SNRs, verifying the significant hadronic gamma-ray components. We argue that the target interstellar protons, in particular their spatial distribution, are essential in any attempts to identify the type of particles responsible for gamma-ray emission. The present results confirm that cosmic-ray (CR) energy $\leq$100 TeV is compatible with a scheme in which SNRs are the dominant source of these Galactic CRs.

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