From high-energy to low-energy cosmic rays: mind the gap!

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Abstract

At high energies (> 1 GeV/n), it is well known that cosmic rays (accelerated in situ by supernovae, stellar winds, etc., or simply galactic) colliding with the dense interstellar medium (molecular clouds) generate gamma-ray emission (> a few GeV), but do not otherwise interact with the gas. By contrast, in the same environment but at low energies, cosmic rays (_˜0.1-100 MeV) have two important feedback effects: (i) they ionize the gas, which influences molecular chemistry and star formation; (ii) they generate nuclear spallation reactions, which give rise to new nuclei and gamma-ray lines (mainly below _˜1 MeV). Molecular cloud ionization can be observed using ground-based mm-submm telescopes, while gamma-ray lines are becoming accessible to a new generation of telescopes being proposed in space. While only a few attempts have be made to "bridge the gap" between high-energy and low-energy cosmic rays in the same (star-forming) regions, it is hoped that much progress will be accessible with this new generation of gamma-ray telescopes.

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