All-sky models for cosmic-ray-induced nuclear gamma-ray line emission from the inner Galaxy.

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Abstract

Galactic cosmic rays (GCRs) are widely thought to originate from supernova remnants; however, observations of ionization rates in the interstellar medium (ISM) in the inner Galaxy suggest the presence of an additional low-energy CR components. CR interactions excite nuclei in the ISM, producing MeV gamma-ray line emission through subsequent de-excitation. We construct all-sky models of this emission by combining the CR propagation code GALPROP with the nuclear reaction code TALYS and evaluate its detectability relative to the Galactic leptonic continuum. We find that the de-excitation line emission is strongly enhanced toward the Galactic Center in models including an additional LECR component, while remaining consistent with the available INTEGRAL/SPI observations.

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