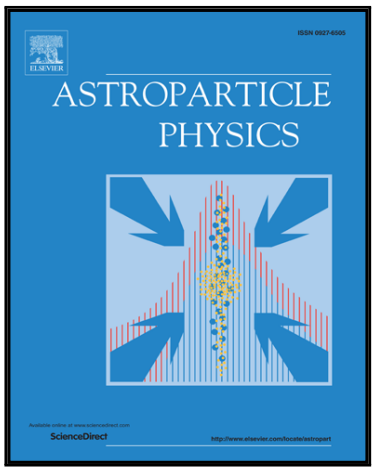

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Probing maximum energy of cosmic rays in SNR through gamma rays and neutrinos from the molecular clouds around SNR W28

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Abstract

The galactic cosmic rays are generally believed to be originated in supernova remnants (SNRs), produced in diffusive shock acceleration (DSA) process in supernova blast waves driven by expanding SNRs. One of the key unsettled issue in SNR origin of cosmic ray model is the maximum attainable energy by a cosmic ray particle in the supernova shock. Recently it has been suggested that an amplification of effective magnetic field strength at the shock may take place in young SNRs due to growth of magnetic waves induced by accelerated cosmic rays and as a result the maximum energy achieved by cosmic rays in SNR may reach the knee energy instead of $\sim$ 200 TeV as predicted earlier under normal magnetic field situation. In the present work we investigate the implication of such maximum energy scenarios on TeV gamma rays and neutrino fluxes from the molecular clouds interacting with the SNR W28. The authors compute the gamma-ray and neutrino flux assuming two different values for the maximum energy reached by cosmic rays in the SNR, from CR interaction in nearby molecular clouds. Both protons and nuclei are considered as accelerated particles and as target material. Our findings suggest that the issue of the maximum energy of cosmic rays in SNRs can be observationally settled by the upcoming gamma-ray experiment the Large High Altitude Air Shower Observatory (LHAASO). The estimated neutrino fluxes from the molecular clouds are , however, out of reach of the present/near future generation of neutrino telescopes.

Keywords: Cosmic rays, supernova remnants, Molecular cloud, TeV gamma rays, TeV neutrinos

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