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Supernova remnants interact with molecular clouds and reveal accelerated hadrons

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Shell-type supernova remnants (SNR) are suspected to be hadronic cosmic-ray (CR) accelerators within our Galaxy. Several shell-type SNR emit very high energy gamma rays detected with H.E.S.S., including RX J1713.7-3946, RX J0852.0-4622, RCW 86 and most recently SN 1006. These observations confirm that these objects accelerate particles up to at least 100 TeV

Dense molecular clouds interacting with SNR blast waves provide direct indications of hadronic acceleration. Several sources detected by HESS may follow such a scenario. The front shock of the SNR CTB 37A is propagating through dense molecular clouds which could be thefabrice.feinstein source of the very high energy gamma-ray emission through the hadronic interactions of shock-accelerated CR.

All the above associations of molecular clouds with SNR coincide with unidentified EGRET sources and will be carefully studied by GLAST.

In addition to a greater sensitivity, the improved angular resolution of future ground-based observatories such as H.E.S.S. phase 2 and the Cherenkov Telescope Array will allow to explore details of the dynamics of such associations.

Summary

Shell-type supernova remnants (SNR) are suspected to accelerate hadrons within our Galaxy. Several shell-type SNR emit very high
energy gamma rays detected with H.E.S.S., including RX J1713.7-3946, RX J0852.0-4622, RCW 86 and most recently SN 1006. These observations confirm that these objects accelerate particles up to at least 100 TeV; however, gamma rays may be produced either by inverse Compton scattering from accelerated electrons or by neutral pion decay after hadronic interactions.

Dense molecular clouds interacting with SNR blast waves may provide more direct indications of hadronic acceleration. Several sources detected by, including those surrounding W28, the newly discovered source HESS J1714-385 coincident with SNR CTB 37A, and the unidentified source HESS J1745-303,
HESS, including those surrounding W28, the newly discovered source HESS J1714-385 coincident with SNR CTB 37A, and the unidentified source HESS J1745-303, may be explained by such a scenario. The front shock of the SNR CTB 37A is propagating through dense molecular clouds which could be the source of the very high energy gamma-ray emission through the hadronic interactions of shock-accelerated CR.

All the above associations of molecular clouds with SNR coincide with unidentified EGRET sources. The greatly improved angular resolution and sensitivity of GLAST should allow a precise determination of the GeV spectrum of these objects.

In addition to a greater sensitivity, the improved angular resolution of future ground-based observatories such as H.E.S.S. phase 2 and the Cherenkov Telescope Array will allow to explore details of the dynamics of such associations.

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