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Hadronic or leptonic astrophysical particle accelerators? Breaking model degeneracy with gamma-ray variability

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Thousands of GeV-emitters have been catalogued by now, with a great variety of object classes therein. A few systems appear particular suitable to probe Galactic cosmic rays, with studies typically revolving around particle acceleration in supernova remnants or pulsar wind nebulae. However, these systems evolve on time scales significantly longer than a human lifetime, virtually preventing the study of their time evolution of particle acceleration and losses. Conversely, we can use the variability induced by the changing conditions along orbits in binary systems or nova explosions to break model degeneracy. The short timescale variability can be used to unambiguously distinguish between leptonic and hadronic accelerators and identify the impact of processes beyond standard diffusive shock acceleration.

After 15 years of observations with the Fermi Large Area Telescope, we have tested particle acceleration in the time domain at GeV energies in a large variety of systems. This large dataset allowed us to break model degeneracy in shocks and jets, whether arising from relativistic or non-relativistic outflows, hence probing diverse conditions in a heterogeneous sample of binaries. In this talk, we will discuss what the observed GeV gamma-ray variability in eta Carinae, RS Ophiuchi and HESS J1832-093 can teach us about the underlying cosmic ray production in Galactic accelerators, and consider the implications for PeVatron searches.

Submitted on behalf of a Collaboration?

Yes

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