Abstract Submitted
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Reconnection-Powered Extreme Particle Acceleration and Gamma-Ray Flares in Crab Nebula[1] DMITRI UZDENSKY, BENOIT CERUTTI, Univ. Colorado-Boulder, MITCHELL BEGELMAN, JILA/Univ. Colorado-Boulder — Recent discovery of gamma-ray flares in the Crab Nebula challenges traditional relativistic particle acceleration models. These flares are presumably produced by PeV electrons radiating >100 MeV synchrotron photons in a milli-gauss magnetic field. In traditional models, where the accelerating electric field is smaller than the magnetic field, synchrotron radiation cannot exceed 100 MeV because radiative losses balance the acceleration rate. We propose that linear electric acceleration in a magnetic reconnection layer can resolve this difficulty. The gyroradii of PeV electrons are so large that their motion is insensitive to small-scale turbulent structures and is controlled only by large-scale fields. As these particles are accelerated by the reconnection electric field, their relativistic Speiser-like orbits collapse deep into the layer and get focused into a tight beam. Furthermore, since perpendicular magnetic field is small inside the layer, the radiation reaction there is suppressed, so the particles can reach higher energies and emit synchrotron radiation in excess of the 100 MeV limit, resolving the Crab gamma-ray flare paradox.

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