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Interpreting the high-energy sub-exponentially cutoff spectral shape of the Vela pulsar

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The Fermi Large Area Telescope (LAT) has detected over 270 pulsars in the GeV range. Their spectra are typically fit with hard power law functions with sub-exponential spectral cutoffs occurring in a narrow band around a few GeV. Recently, a debate ignited over the GeV emission mechanism. Traditionally, this component has been attributed to curvature radiation from the inner magnetosphere; in some later models, such emission predominantly takes place in the current sheet near the light cylinder. Alternatively, particles may be accelerated via magnetic reconnection in the current sheet and emit GeV photons via synchrotron radiation. The outer gap and separatrix/current sheet models both assume curvature or synchro-curvature emission as the mechanism responsible for GeV emission. It has been a challenge for traditional outer gap models to reproduce the sub-exponential GeV tails, while in slot gap / separatrix models, this comes about naturally due to the force-free-like magnetic field structure leading to a particular distribution of local curvature radii of the particle trajectories. In this talk, we present first results of our study of the phase-resolved GeV-band spectrum of the Vela pulsar, indicating the effect of different model parameters on the predicted spectral shape. We also indicate how gamma-ray emission from different heights contribute to the observed spectrum, leading to the build-up of the sub-exponential tail.

Track

Pulsars

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