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From Fermi and NICER data to Pulsar Magnetosphere Models

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The Fermi data imply that the gamma-ray observables, i.e., the gamma-ray luminosity, spectral cut-off energy, stellar surface magnetic field, and spin-down power obey a relation that represents a 3D plane in the 4D log-space. This observed fundamental plane (FP) is remarkably close to the theoretical relation that is obtained, assuming that the pulsar gamma-ray emission is due to curvature radiation. Moreover, I will present advanced kinetic PIC models that reproduce both the shapes of the gamma-ray light curves and the FP. Recent NICER results suggest substantial deviations from the dipolar magnetic field structures. I will present vacuum and FF models corresponding to the sum of off-center dipole and quadrupole magnetic moments that reproduce the hot-spots observed by NICER. Finally, I will show how the Fermi and NICER data, together with the theoretical modeling unite to provide a comprehensive understanding of the high-energy emissions in pulsars.

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