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What have we learned from Fermi Pulsar Light Curve Modelling?

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The Fermi Large Area Telescope (LAT) has caused a revolution in the field of high-energy pulsar science. The number of known pulsars has sky-rocketed from a mere handful prior to its launch to more than 250, and the accumulation of statistics has yielded superior quality light curves in some cases. These developments have stimulated and enabled a flurry of theoretical activity, substantially increasing our understanding of the pulsar phenomenon. While phase-averaged spectra may constrain the radiation energetics, light curves may probe the spatial emissivity distribution and Special Relativistic effects in the pulsar magnetosphere. Low-altitude and extended gap models provided a first framework in which to interpret multi-band light curves, and it was quickly appreciated that by adding data from multiple energy bands, stronger constraints could be derived if a robust statistical method is available to fully exploit such heterogeneous data. Models with extended, high-altitude emission for the bulk of the pulsar population are now unanimously favored, although the GeV emission mechanism is still being debated. Moreover, Fermi's extended energy range enabled the study of multi-band high-energy light curves, while recent ground-based detections of very-high-energy light curves from a few pulsars provide additional energetics and emissivity constraints. Sophisticated MHD and kinetic models indicate that near-force-free magnetospheres (separatrix and current sheet emission) predict light curves that best describe the rich phenomenology of Fermi light curves. In this talk, I will survey the recent theoretical work that has been done on pulsar light curve modelling, and also provide an overview of open problems and new developments in this area of research.

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