Contribution ID: **42** Type: **Contributed Talk**

Modelling Pulsar Gamma-ray Light Curves using a Geometric Current Sheet Model

Thursday 18 September 2025 13:45 (15 minutes)

The publication of the Third Pulsar Catalog (3PC) by the *Fermi* Large Area Telescope (LAT) team marked a significant milestone for high-energy pulsar science. In it, the light curves and spectra of nearly 300 pulsars are presented, along with some interesting correlations between timing and spectral parameters. This wealth of data provides impetus for continued development of pulsar emission models. Over the years, numerous models have been developed, focusing on different physical regimes (e.g., global current flow, magnetic structure, pair creation microphysics, or emission and beaming), and with different outputs (e.g., multi-frequency light curves, multi-component spectra, or single-band pulse shapes only). Magnetohydrodynamic (MHD) and particle-in-cell (PIC) models each have their respective strengths but are often computationally expensive to compute for a suitable coverage of the parameter space. Machine learning has recently been invoked to speed up the process. An alternative, interim step that we are exploring is to implement a geometric current sheet model, akin to the traditional outer gap and two-pole caustic models, but with emission occurring beyond the light cylinder (the magnetospheric boundary where the co-rotation speed equals that of light in vacuum). We will present first results and insights gained by comparing the beamed output (phase plots or sky maps which present beamed emission across the sky) from this model to those of the outer gap and two-pole caustic models, as well as from contrasting the fitting results of some pulsar light curves using the various geometric models. The latter comparison will feature joint fits of radio and gamma-ray light curve data, also using a geometric radio conal model.

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Presenter: VENTER, Christo

Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsar and Pulsar Wind Nebulae