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What Can We Learn from Phase Alignment of Gamma-ray and Radio Pulsar Light Curves?

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<p>The Fermi Large Area Telescope (LAT) has revolutionized high-energy (HE) astronomy, and is making enormous contributions particularly to gamma-ray pulsar science. As a result of the many new pulsar discoveries, the gamma-ray pulsar population is now approaching 100. Some very famous millisecond pulsars (MSPs) have also been detected: J1939+2134 (a.k.a. B1937+21), the first MSP ever discovered, as well as J1959+2048 (a.k.a. J1957+20), the first black widow pulsar system. These along with other MSPs such as PSR J0034-0534 and J2214+3000 (and also including the Crab pulsar), are unique among the pulsar population in that they exhibit nearly phase-aligned radio and gamma-ray light curves (LCs). Traditionally, pulsar LCs have been modeled using standard HE models in conjunction with low-altitude conal beam radio models. However, a different approach is needed to account for phase-aligned LCs. We explored two scenarios: one where both the radio and gamma-ray emission originate in the outer magnetosphere, and one where the emission comes from near the polar caps on the stellar surface. We find best-fit LCs using a Markov Chain Monte Carlo technique for the first class of models. The first scenario seems to be somewhat preferred, as is also hinted at by the radio polarization data. This implies that the phase-aligned LCs are possibly of caustic origin produced in the outer magnetosphere, in contrast to the usual lower-altitude conal beam radio models. We lastly constrain the emission altitudes with typical uncertainties of 10

Level (Hons, MSc,
   PhD, other)?

other

Consider for a student
   award (Yes / No)?

No

Would you like to
 submit a short paper
 for the Conference
 Proceedings (Yes / No)?

Yes

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