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Geometrical models of the linearly polarized pulsar radio emission in the presence of large-scale quadrupolar magnetospheric field

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For nearly six decades of pulsar radio astronomy virtually all observational data interpretation was based on a simplifying assumption that the external magnetic field of a neutron star is that of an inclined dipole. Dipole field model correctly predicts some of key properties of radio pulses, but on per-source basis the discrepancies are ubiquitous. Most recently, compelling evidence for a more complex global magnetic field was provided by modeling the waveforms of thermal X-ray pulsations from a few nearby recycled pulsars. In this work I simulate the behavior of position angle (PA) of the linearly polarized emission component within the framework of a classical Rotating Vector Model, but for a magnetic field with both dipolar and quadrupolar components. I find that for an observationally-supported range of relative magnetic component strength the behavior PA curves show much larger diversity than in the pure dipole case. In the presence of quadrupole field, PA curves can mimic classical S-swing shape for narrow on-pulse windows, however using them to estimate inclination and impact angles may lead to incorrect magnetospheric geometry inferences.

Primary author: BILOUS, Anna

Presenter: BILOUS, Anna

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