Contribution ID: **32** Type: **Contributed Talk**

Towards Modelling AR Sco: Convergence to Aristotelian Electrodynamics and First Results

Wednesday 2 October 2024 14:15 (15 minutes)

The wealth of multi-wavelength observations for AR Sco at high cadence enables measurement of the system parameters versus orbital phase instead of averaging over large ranges of the orbital phase. Current emission and geometric models for AR Sco are unable to accurately and jointly model the light curves, spectra and polarisation signatures of the source AR Sco. Thus, it is crucial to develop an emission model that concurrently reproduces all of these signatures. One needs to solve the general dynamics for highly relativistic particles in large B-fields and induced $E_{\perp}$-fields to account for the mirroring and $\mathbf{E} \times \mathbf{B}$-effects experienced by these particles. To achieve this goal we have constructed a generalised emission model, solving the particle dynamics from first principles, including a generalised radiation-reaction force, and implementing similar radiation calculations to the pulsar emission model of Harding and collaborators.

We will present our particle dynamics' convergence to the radiation reaction regime of Aristotelian Electrodynamics. We will then present our calibration comparison results with the existing pulsar emission model for a pulsar 10% the field strength of Vela. Additionally, we will present two existing synchro-curvature radiation calculation methods identifying if they are appropriate for use in the high $E_{\perp}$-fields present in pulsar magnetospheres. Finally, we will present our first exploratory results simulating the proposed magnetic mirror scenario for AR Sco and fitting the observational spectral energy distribution.

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Session Classification: Pulsars and Pulsar Wind Nebulae

Track Classification: Pulsars and Pulsar Wind Nebulae