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Modelling the high-energy curvature radiation for the Vela pulsar using a general particle dynamics approach.

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AR Sco is a binary system that contains both a white and red dwarf. The spin rate of the white dwarf has been observed to slow down with time, analogous to rotation-powered radio pulsars; it has thus been dubbed a "white dwarf pulsar". We have constructed a sophisticated emission model, solving the particle dynamics from first principles, including a generalized radiation reaction force, and implementing similar techniques to what were used in a pulsar emission code developed by A.K. Harding and collaborators to produce emission maps, light curves and spectra. Additionally, our model is able to probe non-relativistic motion and is thus suitable for magnetic mirror scenarios.
We present our calibration results of the two codes by applying them both to the Vela pulsar. Using the same curvature-radiation calculations as Harding et al. our generated emission maps, spectra and light curves are compared to their results to confirm that our photon phase correction calculations and emission mapping techniques are correct. We can also investigate the effect that the approximations of (i) super-relativistic particles with small pitch angles and (ii) time-averaged pitch angles have on the predictions. Once thus calibrated, we can confidently construct emission maps, light curves, and spectra for AR Sco for much lower Lorentz factors and more generic particle motions.

Track

Pulsars

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