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The anatomy of γ-ray pulsar light curves

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Abstract content
   (Max 300 words)

To obtain constraints on the inclination and observer angles, α and ζ, of a γ-ray pulsar from its observed light curve (LC), we make use of geometric models detailing the position and extent of emission regions (acceleration gaps) in the magnetosphere. We do this by generating a sky map of emission intensity for a range of α, and at each α extracting a complete set of LCs. This yields an atlas of LCs characterised by a specific set of model parameters, such as gap width, position, and radial extent. This atlas can then be used to obtain fits to observed LCs (including rough errors on α and ζ) by eye through a systematic search of the (α,ζ) solution space. For radio-loud γ-ray pulsars, significantly better constraints on the viewing geometry (α and ζ) can be obtained by doing this concurrently for the observed radio and γ-ray LCs. This multiwavelength approach has been used successfully to obtain constraints on the viewing geometries of 6 Fermi-LAT pulsars. It is crucial, however, to understand how the set of model parameters influence the shapes and properties of the LCs contained in a particular atlas, since such an understanding enables improved parameter constraints, and directs future model refinement. A first approach is to study the effect of these parameters on the LCs. This is useful in some respects (and is indeed adequate for the relatively simple radio models). However, due to the complex structure of many of the produced γ-ray LCs, this approach doesn't give a comprehensive enough understanding of how these are produced in terms of the underlying magnetospheric structure and accelerator geometry. In this talk we explore a second approach to investigating the interplay between the model parameters and the LC atlas. Here, we do not attempt to understand how the set of model parameters influence the LC shapes directly, but rather, more fundamentally, investigate how the model parameters affect the sky maps from which the latter are extracted. This allows us to recognise structure within the atlas itself, as we are able to attribute features of the LCs to specific features on the sky map, meaning we not only understand how single LCs come about, but how their structure changes as we move through (α,ζ)-space, and why.

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