Contribution ID: **96** Type: **Oral Presentation**

Orbitally-Modulated X-ray and Gamma-ray Emission from Millisecond Pulsar Binaries

Wednesday, 10 July 2019 11:20 (20 minutes)

Black widow and redback systems are compact binaries in which the pulsar heats and may even ablate its low-mass companion by its intense wind of relativistic particles and emission. The pulsar wind drives mass loss from the companion, and an intra-binary shock forms as a site of particle acceleration. Radio, optical and X-ray follow-up of unidentified Fermi Large Area Telescope (LAT) sources has expanded the number of these systems from four to nearly 30. We model the X-ray and gamma-ray spectral components from nearby 'spider binaries', including diffusion, convection and radiative energy losses in an axially-symmetric, steady-state approach. The code simultaneously yields energy-dependent light curves and orbital phase-resolved spectra. Using parameter studies and fitting X-ray and gamma-ray spectra and light curves, we constrain certain model parameters and estimate the very-high-energy gamma-ray flux for two promising sources. We find that nearby binaries that are in a 'flaring state' are promising targets for the future Cherenkov Telescope Array (CTA), and may also be detectable by H.E.S.S. for optimistic parameter choices. Constraining the inverse Compton emission via such observations will probe the particle acceleration in the shock as well as the pulsar wind content.

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Yes

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MSc

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Session Classification: Astrophysics

Track Classification: Track D1 - Astrophysics