Contribution ID: **107** Type: **Poster**

Radiation and polarization signatures from magnetic reconnection in blazars

Tuesday 11 October 2022 10:33 (1 minute)

Blazars are among the most powerful cosmic particle accelerators in our Universe. Strong multi-wavelength variability suggests extreme particle acceleration locally in the blazar emission region. Previous studies find that shock, magnetic reconnection, and turbulence can be the underlying particle acceleration mechanisms in the emission region. However, most theoretical models involve oversimplified assumptions and unconstrained parameters, diminishing the predictive power. Here we present combined particle-in-cell simulations with polarized radiation transfer. Our first-principle-integrated approach can derive all observables self-consistently with the minimal free parameters. We show that magnetic reconnection is characterized by strong variability in both flux and polarization. In particular, strong gamma-ray flares accompanied by optical polarization angle swings can be attributed to major plasmoid mergers in the reconnection layer, which may be a unique signature for magnetic reconnection. Future high-cadence optical polarization monitoring simultaneous with multi-wavelength light curves can help to identify reconnection in blazars.

Track

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Session Classification: Poster session