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Confronting observations of VHE gamma-ray blazar flares with reconnection models

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Several models have been suggested to explain the fast gamma-ray variability observed in blazars, but its origin is still debated. One scenario is magnetic reconnection, a process that can efficiently convert magnetic energy to energy of relativistic particles accelerated in the reconnection layer. In our study, we compare results from state-of-the-art particle-in-cell simulations with observations of blazars at Very High Energy (VHE, E > 100 GeV). Our goal is to test our model predictions on fast gamma-ray variability with data and to constrain the parameter space of the model, such as the magnetic field strength of the unreconnected plasma and the reconnection layer orientation in the blazar jet. For this first comparison, we used the remarkably well-sampled VHE gamma-ray light curve of Mrk 421 observed with the MAGIC and VERITAS telescopes in 2013. The simulated VHE light curves were generated using the observable parameters of Mrk 421, such as the jet power, bulk Lorentz factor, and the jet viewing angle, and sampled as real data. This is the first time a comprehensive scan of the jet parameters has been evaluated in contrast with the observed data in a quantitative manner. With these results, we pave the way for future model-to-data comparison with next-generation Cherenkov telescopes, which will help further constrain the different variability models.

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