Executive Summary:

Statistical properties of flux variations in blazar light curves at GeV and TeV energies

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Context:

- Blazars show characteristic double humped spectral energy distrib. (low and high energy hump)
- Division into low- and high synchrotron-peaked objects (LSP/HSP) based on low energy hump

Questions:

- What is intrinsic difference between LSP and HSP sources?
- Which processes are responsible for highly variable emission in range of high energy hump?

—> Study and compare (very) high energy variability of such blazars

Data:

- *Fermi*-LAT covers high energy hump of LSP blazars (GeV) -> select the seven brightest sources
- FACT covers high energy hump of HSP blazars (TeV) -> select the three brightest sources
- Consider long term light curves in daily binning (FACT: 9 years; *Fermi*-LAT: 12 years)

Method:

- HOP analysis
  - Interpret light curve as compilation of individual flares
  - define flares based on piece wise constant Bayesian block representation of light curve
  - four different implementations of this method yield similar results
- Ornstein-Uhlenbeck parameter extraction
  - Interpret light curve as stochastic process = discrete Ornstein-Uhlenbeck process
  - Such a process is parametrized with three parameters
    (mu = mean revision level, theta = mean revision rate, sigma = diffusion coefficient)
  - Extract these parameters for every light curve (Burd et al. 2021)

—> Implementation for both methods is public!

HOP: https://github.com/swagner-astro/lightcurves
OU: https://github.com/PRBurd/astro-wue

Results:

- Daily binned GeV (*Fermi*-LAT) as well as FACT flares determined with HOP algorithm result in:
  - Large fraction of single block flares —> flux variations could take place on intra-day timescales
  - No preferred asymmetry for flares with more than one block
- High-energy flux fluctuations could, for instance, be produced by one or several plasmoids moving along the jet (Meyer et al. 2021)
- Ornstein-Uhlenbeck parameter extraction indicates that amplitude of random fluctuations differ for the samples considered