



Study of the origin of rapid variability observed in blazars



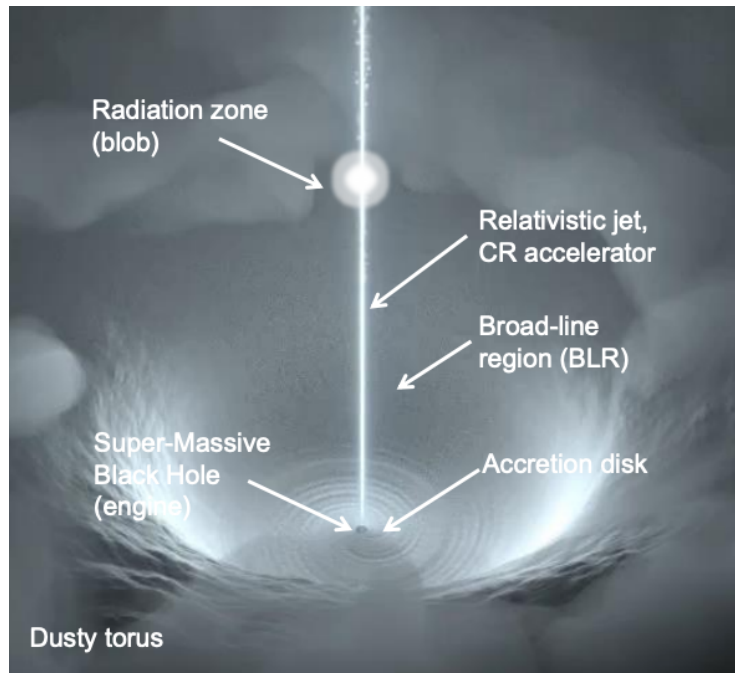
Credits : NASA/JPL-Caltech/Handout

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Study of the origin of rapid variability observed in blazars

Goal : Identify the mechanisms at play in the relativistic jets, responsible for the observed variability of blazars (VHE)



- Blazars: Radio loud galaxies, extragalactic sources GeV - TeV
- Rapid variability $\rightarrow \sim \text{min}$
- Relativistic effects
- Origin of the flares ?

- Observations
- Multiwavelength data analysis
- Radiative transfer modeling

Credits : A. Fedynitch
Science Communication Lab & DESY

Observations

High Energy Stereoscopic System (H.E.S.S.)

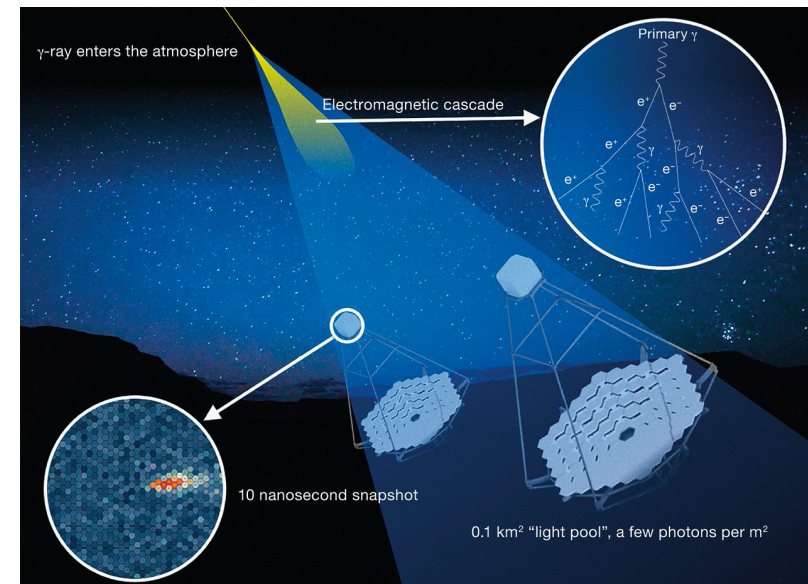


30 GeV – 100 TeV

+ Fermi-LAT, Swift, NuSTAR, available optical and radio data

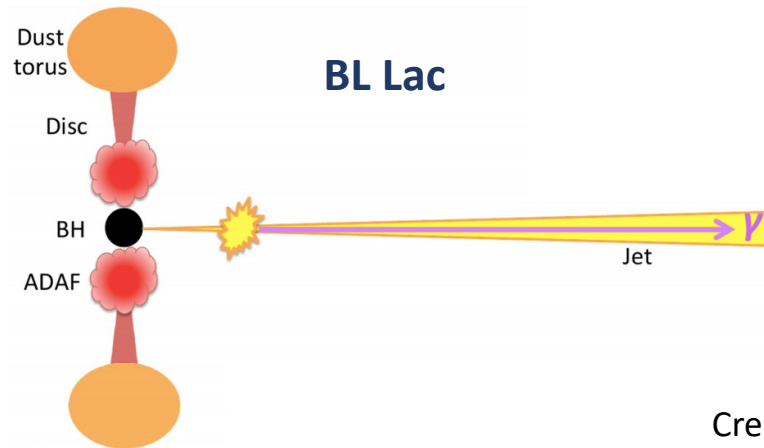
ToO Group

Real-time monitoring of blazars

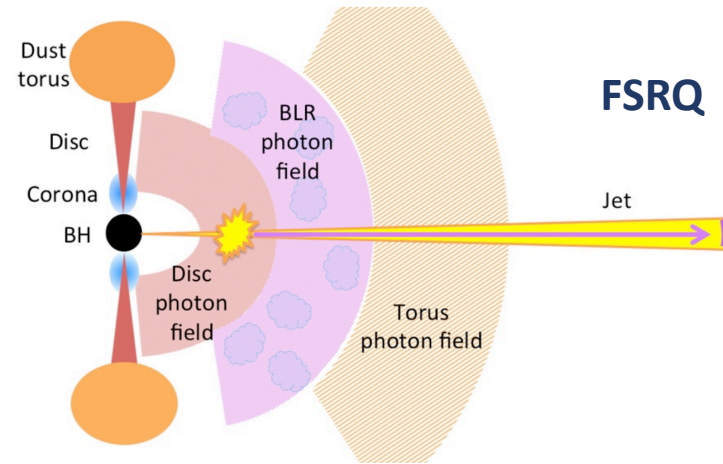


SED – radiative processes

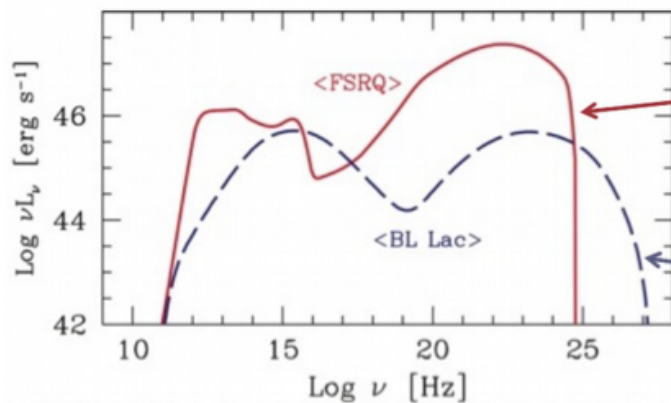
SSC (Synchrotron self Compton)



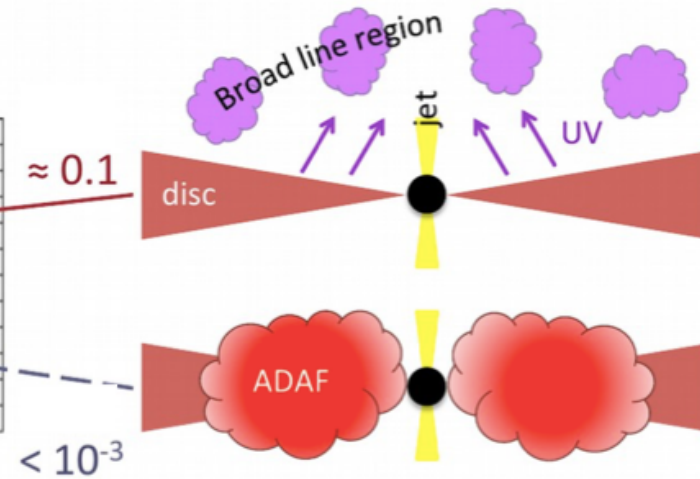
SSC + external photon field interactions



Credits: D. Kynoch



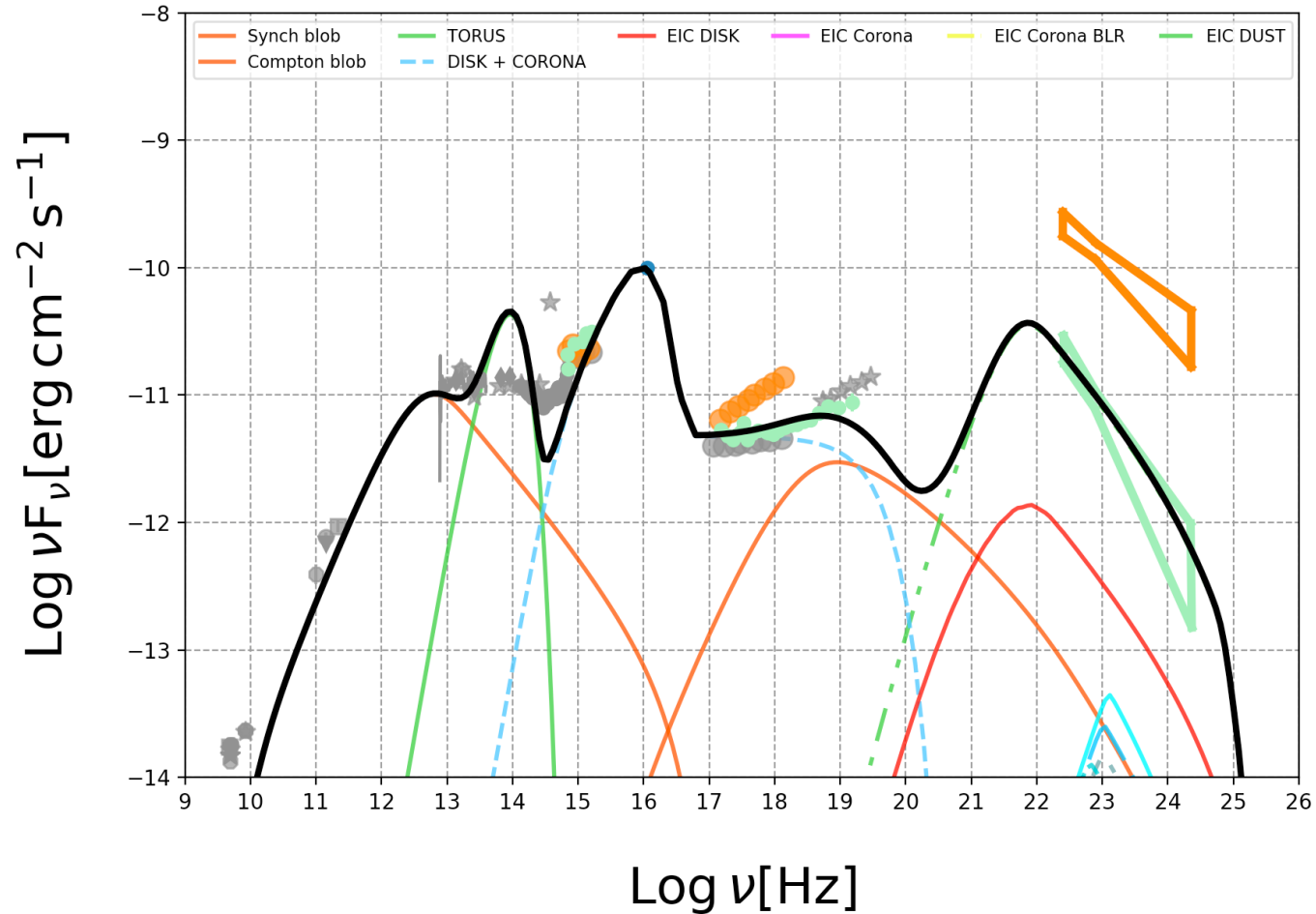
Ghisellini et al. (2010)



Time-dependent modeling of FSRQs

LEHA - Lepto-Hadronic Blazar Emission Model

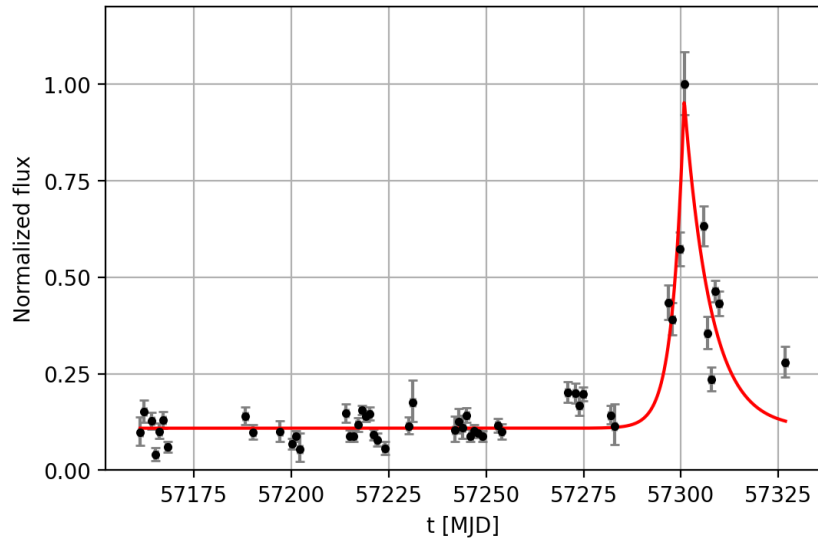
1 H0323+342 (NLS1)



- One zone stationary homogeneous SSC model (degenerate solution), Katarzynski et al. 2001
- Multi component modeling
- Quasi-simultaneous multiwavelength data
- Description of the transition from quiescent to flaring state

Flares - Asymmetry analysis

PKS 2155-304 - HESS data (2015)



Main constraints:

- Limited time resolution + photon statistics
- Different observational constraints for ground-based and space telescopes
- Weather conditions
- ToO program
- Missing information - Light curves

Roy et al. (2018), Chatterjee et al. (2012), Abdo et al. (2010)

$$f(t) = \begin{cases} f_0 + f_{max} e^{\frac{(t-t_0)}{T_r}} & t < t_0 \\ f_0 + f_{max} e^{\frac{-(t-t_0)}{T_d}} & t > t_0 \end{cases}$$

Asymmetry parameter

$$k = -0.39 \pm 0.08$$

$$T_r \sim 3 \text{ (d)} \quad T_d \sim 7 \text{ (d)}$$

$$k = \frac{T_r - T_d}{T_r + T_d}$$

- Analysis and interpretation of the multiwavelength data using radiative transfer models describing emission zones in the jets
- Distinguish the importance of different processes (acceleration, particle losses ...)
- Time-dependent modeling of FSRQs
- Tests: different scenarios and hypothesis
- Upcoming CTA (Cherenkov Telescope Array) project, promising for AGN and HEA in general

Thank you !