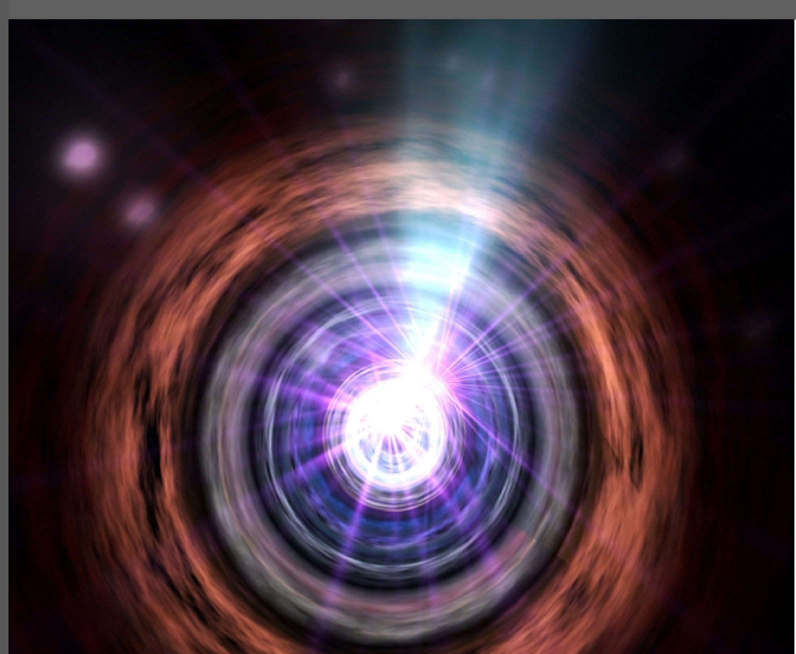
Broadband study of BL Lac during flare of 2020: Spectral evolution and emergence of HBL component

Raj Prince
Center For Theoretical Physics, (PAS)
Al.Lotnikov 32/46, PL-02-668 Warsaw, Poland
Email: raj@cft.edu.pl

An overview on Blazars



Blazar is a special class of AGN, possess a relativistic jets perpendicular to the accretion disk plane and highly oriented towards the observer. It exhibits significant flux variability across the entire wavebands and is characterized by double peaked spectral energy distribution (SED) with one peak extend from radio to soft X-ray, and another peak from X-ray to very high energy gamma-ray. BL Lacertae (BL Lac) objects are class of blazar having weak or possibly no optical emission lines. Based on the location of their first peak BL Lac are further classified as low BL Lac (LBL, < 10^14 Hz), intermediate BL Lac (IBL, 10^14 ≤ 10^15 Hz), and high BL Lac (HBL, ≥ 10^15 Hz) (Padovani & Giommi 1995). BL Lac source is a TeV blazar and considered as a possible source of astrophysical neutrinos. The brightest X-ray flare ever detected from this source was observed by Swift in 2020. The variability is characterized by the fractional variability amplitude. A broadband SED modeling is pursued to understand the possible physical mechanisms responsible for broadband emission.

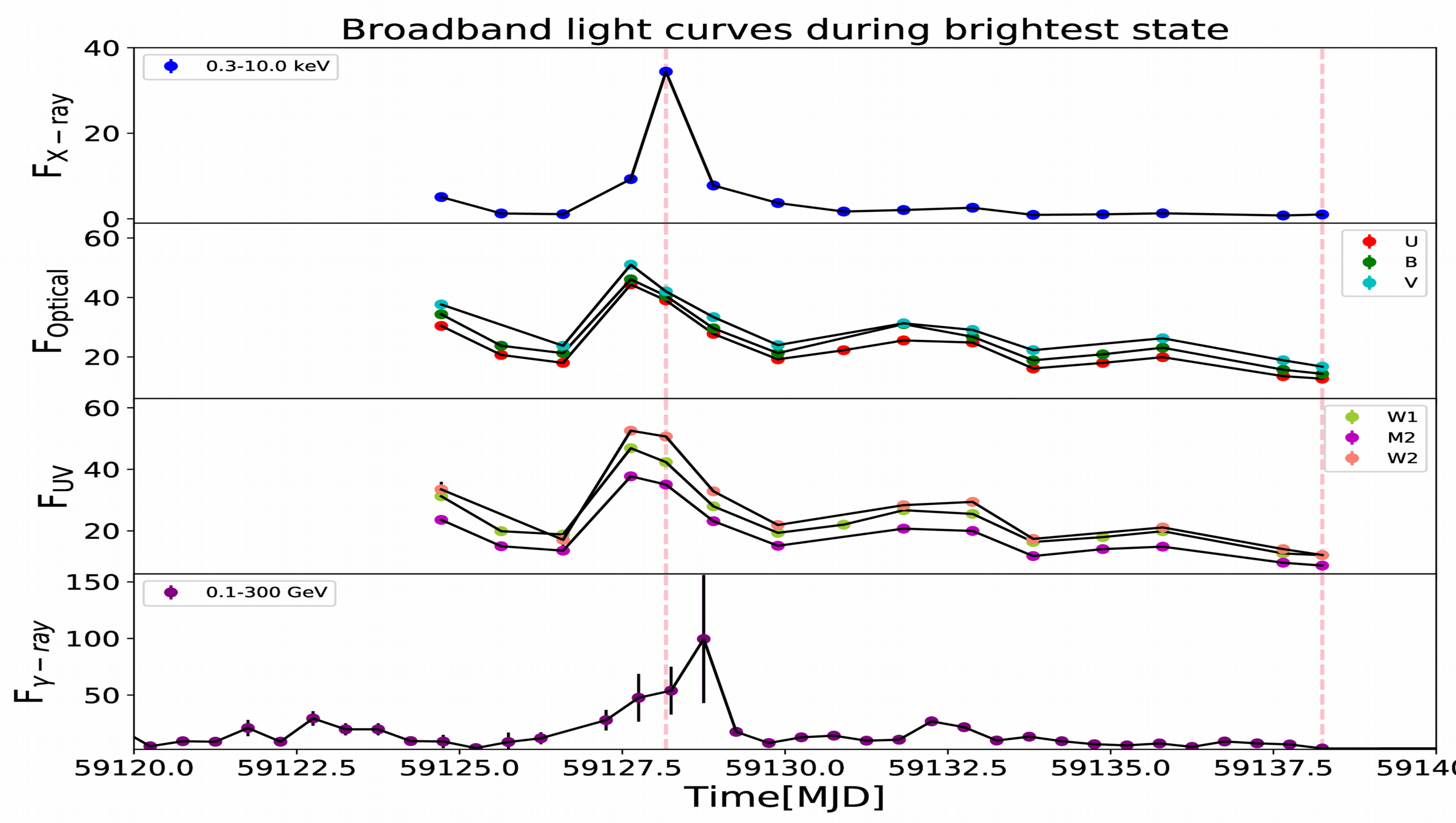
Objectives

- In this work, I analyse broadband observations of the BL Lac source during the period 2020 and perform a detailed investigation of the X-ray spectral curvature.
- To gain a better insight into the physics behind the X-ray spectral curvatures, I modeled the broadband SED with two-zone emission model.

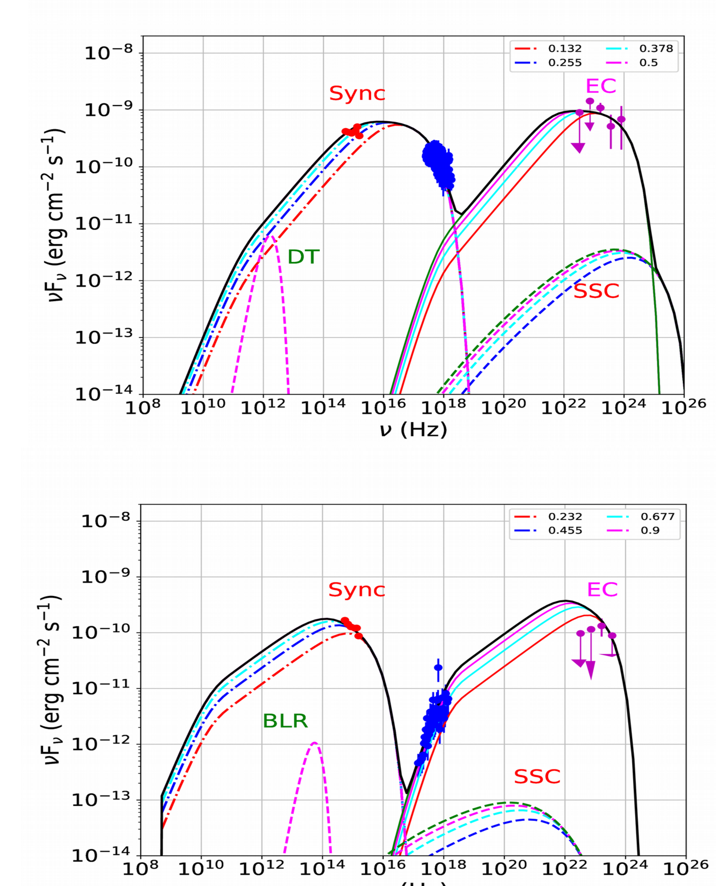
About BL Lac

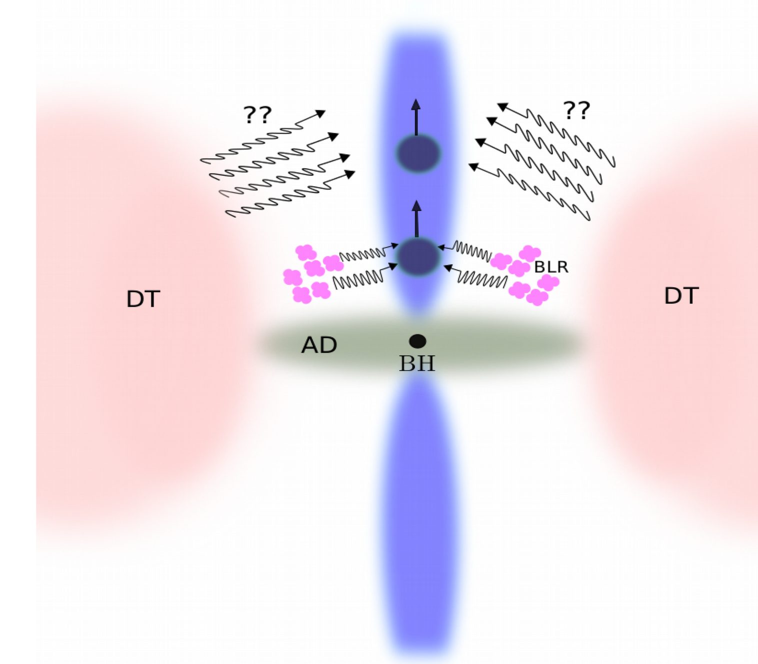
- BL Lac (z=0.069) is a low frequency BL Lac (LBL) object.
- In 2020, the brightest X-ray flare has been observed.
- Simultaneous coverage in optical-UV and gamma-ray provides an excellent opportunity to model the broadband SED and understand the physical mechanism responsible for such X-ray flare.

Broadband LCs

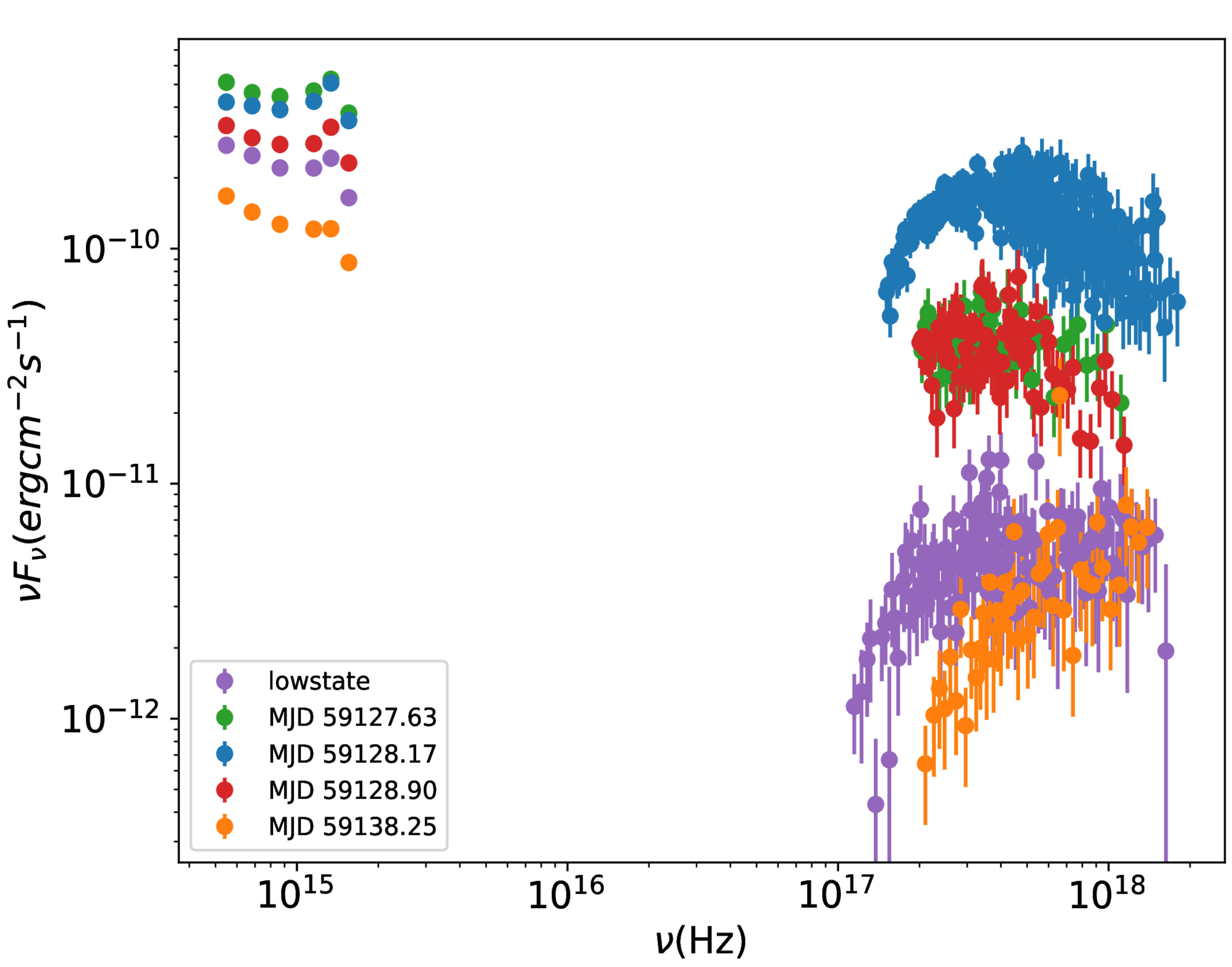


Proposed Model and Results





Spectral Evolution



Results and Conclusions

- From the results I obtained, It is noted that the source showed a maximum X-ray as well as optical flux in its history. Further, the source is found to be highly variable in X-ray with fractional variability above 100%.
- The fastest variability time of 11.28 hours has been detected within a day.
- From broadband modeling study, it is understood that two emission-zone located at two different sites will be required to explain the broadband SED during low and high flux states.
- A significant spectral change is observed suggesting an emergence of new HBL component.

REFERENCES

- Prince 2021, MNRAS, 2021, 507, 5602-5612
- Padovani P., Giommi P., 1995, ApJ, 444, 567

Gamma 2022 Symposium, 04-08 July 2022, Barcelona, Spain