Dr. Zahir Ahmad Shah

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Research Interests

My research interest mainly involves the study of **broadband spectral and temporal properties of blazars** using multi wavelength data from various astrophysical observatories. This includes **developing analysis scripts** to automate the data reduction process and numerical codes to interpret the reduced data using theoretical emission models. I am also involved in obtaining the **analytical/numerical solutions of the particle distribution in the acceleration and cooling regions** for different scenarios of perturbations to the accleration time-scale, cooling time-sale and injection rates. Besides this, I am also involved in characterization of temporal properties of longterm light curves of blazars.

Education

Ph.D.	University of Kashmir	2018
Thesis: Understanding the Spectral and Temporal Behaviour of High Energy Blazars		
Supervisor: Prof. Naseer Iqbal		
Co-Supervisor: Dr. Sunder Sahayanathan		
M.Phil.	University of Kashmir	2014
M.Sc. in Physics	University of Kashmir	2011
B.Sc.	University of Kashmir	2009
Higher Secondary	J&K State Board of School Education	2006
Secondary School	J&K State Board of School Education	2004

National Exam

Qualified Joint CSIR-UGC National Eligibility Test (NET), All India Rank: 15.

Post-Doctoral Fellowship

2018–2021	Inter-University Centre for Astronomy and Astrophysics (IUCAA), Pune
2021–Present	INSPIRE Faculty at Central University of Kashmir

Teaching Experience at University Level

Quantum Mechanics

Relativistic Quantum Mechanics

Mathematical Physics

Research Grants

Co-investigator, ISRO AstroSat data utilization project, Rs. 18.37 Lacs.

DST INSPIRE Faculty Fellowship of 77.40 lacs and research grant of Rs. 35 Lacs over five years.

PROFESSIONAL SERVICE

Served as a Peer-reviewer for the Nature Journals (**Nature Communications**.)

Served as a Peer-reviewer for the **The Astrophysical Journal Supplement Series**.

Served as a Peer-reviewer for the **Monthly Notices of the Royal Astronomical Society**.

Research Highlights

Broadband spectral and temporal data analysis techniques across multiple wavelengths.

Theoretical spectral modeling of blazars.

Time resolved spectral study of blazars.

Constraining High Energy (X-ray and gamma-ray) emission in Blazars.

Prediction of VHE Blazars for upcoming VHE telescopes.

Obtain constraints on EBL estimation using the VHE observations.

Numerical/Analytical solutions of Fokker-Plank equations

Statistical and simulation study of blazar light curves.

Research Expertise

Data analysis: Fermi-LAT, TACTIC, Swift-XRT, Swift-UVOT, NuStar, AstroSat SXT/LAXPC, UVIT, .

Theoretical SED modeling, numerical/analytical solutions for Fokker-Plank equation.

Computational/graphical skills: Python, FORTRAN, XSPEC, PYXSPEC, Gnuplot, Matplotlib.

Research Fellowships

Junior and Senior Research Fellowship (JRF & SRF), ISRO-RESPOND Project.

Post-Doctoral Fellowship, IUCAA.

INSPIRE Faculty Fellowship, DST.

Collaborations

University of Kashmir, ApSD BARC Mumbai, IUCAA Pune, IIA, IISER Mohali, Tezpur University, University of Southampton, NIT Rourkela, Unversity of Nizwa

Accepted Proposals

Principle Investigator (PI) in "Investigating the Spectral Breaks and Thermal Emission of High Red shift Flat Spectrum Radio Quasars using AstroSat", A03-77

Principle Investigator (PI) in "Investigating the broad band Spectral energy distribution Bl Lac blazars using AstroSat", A04-094

Principle Investigator (PI) in "Multi-wavelength observation of FSRQ PMNJ1923-2104 during its active phase using AstroSat", T03-018

Co-Investigator (Co-PI) in "Observation of Mrk 421 with AstroSat during the present flaring activity", T01-218

Co-Investigator (Co-PI) in "Investigation the broadband spectral shape of Mrk 180 using multi-wavelength observation from AstroSat", A05-064

Co-Investigator (Co-PI) in "X-ray/UV study of the high energy peaked blazar PKS 0352-686", A05-202

Publications

1. **Shah Zahir**, et al , "Comprehensive variability analysis of blazars using Fermi light curves across multiple timescale", *Phys. Rev. D*, 2025, 111, 123052 DOI: https://doi.org/10.1103/61tz-jk8c (**Impact Factor-5.3**)
2. Peer Anjum, Dar Athar A, Shah Zahir et al "Multiwavelength spectral and temporal analysis of VHE Blazar 1ES 1959+650: Tracing emission mechanisms across flux states", *MNRAS*, 2025, https://doi.org/10.1093/mnras/staf2031 (**Impact Factor-4.8**)
3. Sikandar A., **Shah Zahir**, et al., "Indication for dual periodic signatures in PKS0805-07 from multi-technique time series analysis", *Phys. Rev. D (PRD)*, 2025, https://doi.org/10.1103/zxgv-fzv5 (**Impact Factor-5.3**)
4. Dar Athar, **Shah Zahir**, et al, "Unraveling the broadband spectrum of B2 1308+326: A clue to its high energy emission mechanism", *New Astronomy*, 121 (2025) 102463, https://doi.org/10.1016/j.newas
5. **Shah Zahir**, " Multi-wavelength variability and broadband SED modeling of BL Lac during a bright flaring period MJD 59000-59943", *MNRAS*, 2024, 527, 5140–5154 (**Impact Factor-4.8**)
6. Malik Zahoor, Akbar Sikandar, **Shah Zahir**, et al, "Statistical Insights into Flux and Photon Index Distributions of VHE FSRQs from Fermi-LAT Observations", *MNRAS*, 2025, 539, 3, 2185–2201, https://doi.org/10.1093/mnras/staf620 (**Impact Factor-4.8**)
7. Tantry Javaid , Sharma Ajay, **Shah Zahir**, Iqbal Naseer and Bose Debanjan "Study of multi-wavelength variability, emission mechanism and quasi-periodic oscillation for transition blazar S5 1803+784", *JHEAP*, Volume 47, July 2025, 100372 (**Impact Factor-10.2**)
8. Ahanger Sajad, Sahayanathan Sunder, Sitha K. Jagan, **Shah Zahir**, Naseer Iqbal "Multi-wavelength analysis of FSRQ B2 1348+30B: Constraints on the jet power", *JHEAP*, 2025, https://doi.org/10.1016/j.jheap.2025.100400
9. Sikandar A., **Shah Zahir**, et al., "Probing spectral evolution and intrinsic variability of Mkn 421: A multi-epoch AstroSat study of X-ray spectra", *JHEAP*, 2025, 45, 438-455 (**Impact Factor-10.2**)

10. **Shah Zahir**, et al. "AstroSat observation of the HBL 1ES 1959+650 during its October 2017 flaring", *MNRAS*, 2022, 504, 5485–5495 (**Impact Factor-4.8**)

11. **Shah Zahir**, et al. "Unveiling the broadband spectral and temporal properties of PKS 0903-57 during its brightest flare", *MNRAS*, 2021, 504, 416–427 (**Impact Factor-4.8**)

12. Tantry J., **Shah Zahir** et al. "Probing broadband spectral energy distribution and variability of Mrk 501 in the low flux state", *JHEAP*, 2024, 44, 393–409 (**Impact Factor-10.2**)

13. Sikandar A., **Shah Zahir**, et al. " Insights into the Long-Term Flaring Events of Blazar PKS 0805-07: A Multi-Wavelength Analysis over the 2009-2023 Period", The Astrophysical Journal (ApJ), 2024, 977, 111 (**Impact Factor-4.8**)

14. **Shah Zahir**, et al. "On the determination of log-normal flux distributions for astrophysical systems, *MNRAS*, Volume 496, Issue 3, August 2020, Pages 3348–3357 (**Impact Factor-4.8**)

15. **Shah Zahir**, et al. "Study on temporal and spectral behavior of 3C 279 during 2018 January flare", *MNRAS*, 484, 3168-3179 (2019) (**Impact Factor-4.8**)

16. Manzoor A., **Shah Zahir**, et al. "Broadband spectral and temporal study of Ton 599 during the brightest January 2023 flare", *MNRAS*, 2024 (**Impact Factor-4.8**)

17. **Shah Zahir**, et al. "Log-normal flux distribution of bright Fermi blazars", *RAA*, 2018, 18, 11, 141 (**Impact Factor-1.8**)

18. **Shah Zahir**, et al. "Clues on high-energy emission mechanism from blazar 3C 454.3 during 2015 August flare, *MNRAS*, 2017, Volume 470, Issue 3, p.3283-3299 (**Impact Factor-4.8**)

19. Khatoon R, **Shah Zahir**, et al "Study of long-term flux and photon Index distributions of blazars using RXTE observations, *MNRAS*, 491, 2, 2020 (**Impact Factor-4.8**)

20. Khatoon R, **Shah Zahir**, et al., "Correlations between X-ray spectral parameters of Mkn 421 using long-term Swift-XRT data, *MNRAS*, 2022, 515, 3 (**Impact Factor-4.8**)

21. Rajput B., **Shah Zahir**, et al. "Correlation between optical and γ-ray flux variations in BL Lacs", 2021, *MNRAS* (**Impact Factor-4.8**)

22. Deka K., **Shah Zahir**, et al "The long-term X-ray flux distribution of Cygnus X-1 using RXTE-ASM and MAXI observations, *JHEAP*, 31, 2021, 23-30 (**Impact Factor-10.2**)

23. Hota J., **Shah Zahir**, et al "Understanding the X-ray spectral curvature of MKN 421 using broadband AstroSat observations", *MNRAS*, 2021 (**Impact Factor-4.8**)

24. M Zahoor, **Shah Zahir**, et al "Multiwavelength study of blazar 4C + 01.02 during its long-term flaring activity in 2014-2017", *MNRAS*, 2022, 514, 4259-4269 (**Impact Factor-4.8**)

25. Dar A., **Shah Zahir**, et al "Can FSRQ 3C 345 be a very high energy blazar candidate?", *MNRAS*, 2024, 527, 10575–10583 (**Impact Factor-4.8**)

26. M Zahoor, Sahayanathan, **Shah Zahir**, et al "Model-independent Redshift Estimation of BL Lac Objects through VHE Observations, *MNRAS*, 2021 (**Impact Factor-4.8**)

27. M Zahoor, Sahayanathan, **Shah Zahir**, et al "Very-high-energy flat spectral radio quasar candidates", *MNRAS*, 515, 3, 4505-4513 (**Impact Factor-4.8**)

28. Xiongfei G., ..., **Shah Zahir**, et al " Exploring γ-Ray Flares in the Long-term Light Curves of CTA 102 at GeV Energies" , *The Astrophysical Journal Supplement Series*, 2022, 260:48 (29pp) (**Impact Factor-8.8**)

29. Manzoor A., **Shah Zahir**, et al "Understanding the very high energy γ-ray excess in nearby blazars using leptonic model, *MNRAS*, 2023, 525, 3, 3533-3540 (**Impact Factor-4.8**)

30. Thekkoth A., Sahayanathan, **Shah Zahir**, et al "Understanding the broad-band emission process of 3C 279 through long term spectral analysis", *MNRAS*, 2023, 526, 4, 6364-6380 (**Impact Factor-4.8**)

31. M SHOWKAT, I Naseer, **Shah Zahir**, "Search of Astrophysical results with LIGO from the Science runs S1 to S5", *JOURNAL OF ADVANCES IN PHYSICS* 6 (3)

32. Khatoon R., Prince R, **Shah Zahir**, et al "Temporal and spectral study of PKS 0208−512 during the 2019–2020 flare", *MNRAS*, 2022, 513, 611-623 (**Impact Factor-4.8**)

33. Khan S, H. Abdullah; **Shah Zahir**, et al "The Fluctuation Theory, Critical Phenomena and Gravitational Clustering of Galaxies", 2025, *Journal of Astrophysics and Astronomy*, accepted for publication.

Conference Proceedings:

34. Khatoon R., **Shah Zahir** et al. "Flux Distribution Study of Mkn 421 with SPOL, RXTE and Fermi-LAT Telescopes, *Springer Proceedings in Physics*, DOI:10.1007/978-981-16-5141-0_13.

35. Deka K., **Shah Zahir** et al. " A study of the effects of histogram binning on the accuracy of finding flux distribution of X-ray binaries", Materials Today: Proceedings, Volume 65, Part 5, 2022, Pages 2862-2864

36. Deka K., **Shah Zahir** et al. " Distribution of X-ray flux: RXTE-PCA Observation of Cygnus X-1", Materials Today: Proceedings, Volume 65, Part 5, 2022, Pages 2862-2864.

37. Deka K., **Shah Zahir** et al. "Distribution of X-ray flux: RXTE-PCA observation of Cygnus X-1, Conference: Springer International Conference on Trends in Modern Physics 26-27 February 2021.

38. **Shah Zahir** et al "Understanding the evolution of X-ray spectral properties of blazars using broad-band AstroSat observations", in 44th COSPAR Scientific Assembly, vol. 44, Jul. 2022, p. 2243.

39. J. Hota, **Shah Zahir** et al. "X-ray Spectral study of MKN 421 using Astrosat observation, in 44th COSPAR Scientific Assembly, vol. 44, Jul. 2022, p. 2245.

40. R. Khatoon, R. Misra, **Zahir Shah**, J. Hota, R. Gogoi, and A. Charan Pradhan, "Correlations between X-ray spectral parameters of Mkn 421 using long-term Swift-XRT data," in 44th COSPAR Scientific Assembly, vol. 44, Jul. 2022, p. 2075.

Conference Presentations

Oral Presentations/Resource person:

- *Astrosat & XPoSatWorkshop 2024, 28 February - 03 March 2024* at Providence Womens College Kozhikode, participated as resource person in the Workshop.
- *Advanced Astrosat Data Analysis Workshop 9-15 January 2023*, participated as resource person in the Workshop.

- *Himalayan Meet of Astronomers 2023 at IUST, Awantipora, 25-26 September 2023*, gave an invited talk on "Understanding Broadband Emission from Blazars" and chaired one scientific session on blazars.
- *4th National Conference on High Energy Emission from Active Galactic Nuclei*, gave an invited talk on "Temporal behavior of blazar light curves" and chaired one scientific session on blazars.
- *Introductory Workshop in Astronomy and Astrophysics, 18–19 December, 2021*, gave an invited talk on "Active Galaxies - Brightest Objects in the Universe".
- *2nd China-India Workshop on High Energy Astrophysics, 6–10 December 2021*, gave an invited talk on "Understanding the evolution of X-ray spectral properties of blazars using broadband AstroSat observations".
- *IUCAA Annual Seminars by Post-Doctoral Fellows - 2021*, gave a presentation on "Broadband Spectral and Temporal Study of Blazars".
- *One day online meeting on Theoretical Aspects of High Energy Emission from AGN held on 06 July 2021*, gave an invited talk on "Time Resolved Spectral Study of 1ES,1959+650 using AstroSat Observations.
- *Astrophysical jets and observational facilities: National perspective, 05-09 April 2021*, gave a talk on "AstroSat observation of the HBL 1ES,1959+650 during its October 2017 flaring".
- *Astronomy Group Seminar Programme, University of Southampton*, gave a seminar "Flux distribution study of *F*ermi bright blazars and simulated light curves" on Mon 14 Oct 2019.
- *4th National conference on Recent Trends in the Study of Compact Objects: Theory and Observation (RETCO-IV) 17 - 20 April 2019, IUCAA, Pune*, presented the work "Study on temporal and spectral behaviour of 3C 279 during 2018 January flare"
- *Growth Points in Physics (GPP-2017)*, UGC Sponsored National Seminar, held at University of Kashmir, Srinagar, 21-23 October 2017
- *High Energy Emission from Active Galactic Nuclei*, 3^{rd} national conference, held at University of Calicut, Kerala, 28-30 November, 2017
- *Last Friday Talk at IUCAA on 25 January 2019*, presented the work "Multiwavelength study of 3C 279 during 2018 January flare"
- *Astronomical Society of India (ASI)*, 34^{th} meeting held at Kashmir University, Srinagar, 10-13 May, 2016

Poster Presentations:

- *Young Astronomers Meet (YAM) 2017*, organized by the IUCAA during 11-15 September, 2017
- *IUCAA Science day foundation 2019*, organized by the IUCAA on 28 February, 2019

Participations:

- *AstroSat Calibration Meeting*, Hosted by AstroSat Science Support Cell, IUCAA, Pune , 23-24 August 2022.
- *AstroSat Data analysis*, workshop organised by IUCAA, 13-16 Nov. 2017

- *AstroSat AO Proposal submission*, workshop organised by IUCAA, 13-14 July 2016
- *Extragalactic Relativistic Jets: Cause and Effect*, hosted by ICTS Bangalore, 12-20 Oct. 2015
- *Radio Astronomy School*, organized by National Center for Radio Astronomy (NCRA), Pune , 19-30 August 2013
- *Astronomical Techniques and Science with Virtual Observatories*, jointly organized by Department of Physics (Kashmir University) and Inter University Centre for Astronomy and Astrophysics (IUCAA, Pune), 23-26 Sep. 2013
- *High Energy Emission from Active galactic Nuclei (AGN)*, Jointly organised by department of physics (University of Kashmir), Board of Research in Nuclear Science (BRNS) BARC., and Indian Space Research Organisation (ISRO)., 7-9 Oct. 2013
- *Stellar Astrophysics*, jointly organized by Department of Physics (University of Kashmir, Srinagar) and Inter University Centre for Astronomy and Astrophysics (IUCAA), Pune, 24-26 Oct. 2011
- *High Energy Astrophysics*, winter School, organized by ApSD Bhaba Atomic Research Centre (BARC) at Mount Abu Rajistan, 28 January to 3rd February, 2011
- *Participate in Online International workshop on VHE Data Analysis using Open Source Packages*, University of Kashmir, Srinagar, 1-3 February 2022.

References

Prof. Naseer Iqbal, Department of Physics, University of Kashmir, dni_phtr@kashmiruniversity.ac.in

Prof. Ranjeev Misra, IUCAA PUNE, rmisra@iucaa.in

Prof. Debanjan Bose, Department of Physics, Central University of Kashmir, Ganderbal debanjan.bose@cukashmir.ac.in