Ashwani Pandey

Ph.D. in Physics (Astronomy & Astrophysics)

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Research Profile

I study how relativistic jets in active galactic nuclei accelerate particles and produce $\gamma-$rays, and how the gas around the jet shapes that emission. On the jet side, I combine multiwavelength observations from optical to very-high-energy $\gamma-$rays (*Swift*, *NuSTAR*, *XMM-Newton*, *Fermi-LAT*, *VERITAS*) with broadband modeling to probe particle acceleration and the location of the γ-ray emitting region in blazars. On the gas side, I use CLOUDY photoionization models to constrain the structure, dust content, and Fe II emission of the broad-line region (BLR), which supplies seed photons and can absorb VHE γ-rays. Changing-look and/or transition blazars bring the two together, because a change in accretion state should alter both the jet emission and its surroundings.

Research Experience

Jun 2026 – present	**Visiting Researcher** *with Prof. Luis C. Ho* Kavli Institute for Astronomy and Astrophysics (KIAA), Peking University, Beijing, China
Apr 2026 – present	**Research Affiliate** Department of Physics & Astronomy, University of Utah, Salt Lake City, UT, USA
Sep 2024 – Mar 2026	**Postdoctoral Research Associate** *with Prof. Qi Feng* Department of Physics & Astronomy, University of Utah, Salt Lake City, UT, USA
Apr 2024 – Aug 2024	**PIFI Visiting Scientist** *with Prof. Jian-Min Wang* Institute of High Energy Physics (IHEP), Chinese Academy of Sciences, Beijing, China
Nov 2022 – Aug 2024	**Postdoctoral Fellow** *with Prof. Bozena Czerny* Center for Theoretical Physics PAS, Warsaw, Poland
Jan 2021 – Nov 2022	**Postdoctoral Fellow** *with Prof. C. S. Stalin* Indian Institute of Astrophysics (IIA), Bengaluru, India
Jun 2019 – Jan 2021	**Postdoctoral Fellow** Aryabhatta Research Institute of Observational Sciences (ARIES), Nainital, India

Education

2014–2019	**Ph.D. in Physics (Astronomy & Astrophysics)** Thesis submitted: Apr 25, 2019 | Degree awarded: Nov 1, 2019 ARIES / Deen Dayal Upadhyaya (DDU) Gorakhpur University, U.P., India *Thesis:* Multi-wavelength Studies of TeV Blazars *Supervisor:* Dr. Alok Chandra Gupta (Scientist-G, ARIES) | *Co-supervisor:* Prof. S. N. Tiwari (DDU)
2011–2013	**M.Sc. in Physics** Kumaun University, Nainital, Uttarakhand, India
2009–2010	**Bachelor of Education (B.Ed.)** Kumaun University, Nainital, Uttarakhand, India
2005–2008	**B.Sc. in Physics, Chemistry & Mathematics** Kumaun University, Nainital, Uttarakhand, India

Selected Publications in Peer-Reviewed Journals

Five representative publications are listed below; the full list (total: 47, including 14 lead author) is provided in the attached document.

1. *"New theoretical Fe II templates for bright quasars"*
   Ashwani Pandey, M. L. Martinez-Aldama, B. Czerny, S. Panda, M. Zajacek, J.-M. Wang, Y.-R. Li, P. Du
   Astrophysical Journal Supplement Series, 277, 36, 2025. DOI: 10.3847/1538-4365/adb427
2. *"B2 1308+326: a changing-look blazar or not ?"*
   Ashwani Pandey, Chen Hu, Jian-Min Wang, Bozena Czerny, Yong-Jie Chen, Yu-Yang Songsheng, Yi-Lin Wang, Hao Zhang, and Jesus Aceituno
   Astrophysical Journal, 978, 120, 2025. DOI: 10.3847/1538-4357/ad9b7c
3. *"Origin of broadband emission from the transition blazar B2 1308+326"*
   Ashwani Pandey, P. Kushwaha, P. J. Wiita, R. Prince, B. Czerny, C. S. Stalin
   Astronomy & Astrophysics, 681, 116, 2024. DOI: 10.1051/0004-6361/202347719
4. *"Detection of minute-timescale γ-ray variability in BL Lacertae by Fermi-LAT"*
   Ashwani Pandey, C. S. Stalin
   Astronomy & Astrophysics , 668, 152, 2022. DOI: 10.1051/0004-6361/202244648
5. *"Correlation between optical flux and polarization variations in Flat Spectrum Radio Quasars on diverse timescales"*
   Ashwani Pandey, Bhoomika Rajput, and C. S. Stalin,
   Monthly Notices of the Royal Astronomical Society, 510, 1809–1836, 2022. DOI: 10.1093/mnras/stab3338

Key Research Projects

- **Joint VERITAS, MAGIC, and LST1 VHE Analysis of OP 313 (B2 1308+326):** Initiated and leading the VERITAS contribution to a joint VERITAS-MAGIC-LST-1 study of OP 313, the most distant known VHE-emitting AGN (z$\sim$1). This continues my earlier lead-author work on the source (A&A 681, 116, 2024; ApJ 978, 120, 2025). I wrote and submitted the VERITAS ToO proposal as PI and the Swift ToO request that triggered observations of the flare, and I am now

coordinating cross-instrument analysis and multiwavelength interpretation with the MAGIC and LST-1 teams. Status: joint manuscript in preparation (for ApJL).

- **VERITAS Multiwavelength Study of BL Lacertae:** Lead author of a multiwavelength study combining VERITAS, Fermi-LAT, X-ray, optical/UV, and radio data. I performed data analysis and wrote the manuscript. Status: under VERITAS collaboration internal review.
- **Fe II Templates for Bright Quasars:** Constructed a comprehensive grid of new theoretical Fe II emission templates (1000–10000 Å) using CLOUDY version C23.0 with the latest Fe+ atomic dataset, spanning a wide parameter space in ionizing flux, gas density, and microturbulence. Templates publicly released on Zenodo and GitHub; published in ApJS (2025).
- **Dusty/Dustless BLR Modeling:** CLOUDY photoionization modeling comparing dusty and dustless BLR plasma using NGC 5548 as a benchmark. Examined reprocessed continua, Hβ and Mg II equivalent widths, and implications for BLR geometry without requiring inner disc–BLR shielding. Published in A&A (2023).

Core Technical Expertise

- Multiwavelength observational studies of AGN, blazars, and relativistic jets using optical, X-ray, high-energy, and VHE γ-ray observations from facilities including *Swift*, *NuSTAR*, *XMM-Newton*, *Fermi*-LAT, and VERITAS.
- Temporal and spectral analysis of variable and transient AGN, including broadband variability studies, spectral evolution, optical polarization, flare characterization, and coordinated multiwavelength campaigns.
- VHE γ-ray data analysis using Gammapy and VEGAS within likelihood-based frameworks, including event reconstruction, spectral extraction, and spatial modeling.
- Photoionization modeling of AGN broad-line regions (BLR) using CLOUDY, including large grid simulations exploring hydrogen density, ionizing photon flux, metallicity, microturbulence, dust content, and cloud geometry under constant-density and constant-pressure conditions.

Astrophysical Software & Tools

- **VHE/IACT:** GAMMAPY, VEGAS (VERITAS Gamma-ray Analysis Suite)
- **High-energy γ-ray:** FERMITOOLS, FERMIPY
- **X-ray:** HEASoft, SAS, CIAO, FTOOLS, XSPEC, DS9
- **Optical:** IRAF/DoPHOT
- **SED modeling:** JetSeT
- **General:** Python, Linux shell scripting, LaTeX, Git/GitHub, Visual Studio Code; extensive HPC environment experience
- **Photoionization modeling:** CLOUDY — model grid construction

Community Products

- **Fe II template library**: Grid of theoretical Fe II templates (1000–10000 Å) computed with CLOUDY C23.0, spanning ionizing flux, density, and microturbulence. Pandey et al. 2025, ApJS 277, 36. Zenodo: zenodo.org/records/14837985 (Downloads (October 2026): 760)
- **AGNSpec:** Open-source Python pipeline for the analysis and spectral decomposition of active galactic nuclei (AGN) spectra (in development). GitHub repository

Observing Experience

VHE $\gamma-$ray (Stereo IACT)

- VERITAS (Arizona, USA): observer, 10 full-night shifts (2024-2026); data quality assessment (run-quality review and flagging); VEGAS and Gammapy analysis; proposal writing and observing strategy.

Optical facilities:

- 1.04-m ST and 1.3-m DFOT (ARIES, Nainital): observer and data analyst for photometry and polarimetry of blazars, multiple nights per cycle during the PhD (2014–2019). Total nights >30.
- 2-m HCT (IIA, Hanle) and 1.3 m JCBT (VBO, Kavalur): observer and data analyst for photometry and spectroscopy of blazars (2021-2022).

Observing Proposals

Principal Investigator

- **Swift Cycle 22 GI** "Swift–NuSTAR ToO of OP 313: probing VHE γ-ray emission"
  Proposal no. 2225253; rated "very good"; above the scientific cut; not implemented due to high oversubscription rate .
- **GIT (GROWTH-India Telescope)** "Optical color variability of blazars"
  Proposal ID:GIT-2022-C1-P14, GIT-2022-C2-P14, GIT-2023-C1-P14; Total >40 h allocated
- **VBO 1-m, Kavalur** "Optical flux and polarization variability of Fermi blazars"
  Proposal ID: ONEM-2022-C1-P3, ONEM-2022-C2-P3, ONEM-2023-C1-P3; selected but no observations due to technical issues.

Co-Investigator

- **NuSTAR Cycle 11 GO** "Searching for neutrino-emitting blazars in the hard X-ray band" (PI: Q. Feng): **accepted, 2×40 ks, coordinated with Swift and VERITAS**
- **3.6 m DOT** "Optical spectroscopy of changing-look blazars"
  Proposal ID: 2025-C2-P47; PI: S. Pandey; **3 h allocated**
- **3.6 m DOT** "Catching the changing-look event in 3C 273"
  Proposal ID: 2024-C1-P16; PI: J. Joshi; **1 h allocated**
- **2 m HCT** "Spectroscopy of Fermi blazar candidates of uncertain type" Proposal IDs: 2022-C1-P34 and C2-P54; PI: B. Rajput; **selected**
- Not allocated: **Swift Cycle 21 (NGC 4278)**; **XMM-Newton**, Proposal no. 096102, (Rapid flares of TeV γ-ray blazars)

Grants, Achievements & Bibliometrics

- **Chinese Academy of Sciences President's International Fellowship Initiative (CAS PIFI) 2023 Visiting Scientist Fellowship**: RMB 120,000 for a six-month visit to IHEP, Beijing, hosted by Prof. Jian-Min Wang.
- National-level competitive exams: **CSIR-UGC NET** (AIR 168), **GATE** (AIR 275), **JEST** (AIR 293)
- NASA ADS (Oct 2026): Citations 627 | h-index 16 | i10-index 24
- Google Scholar (Oct 2026): Citations 782 | h-index 17 | i10-index 23

Research Memberships & Collaborations

- **Member**, International Astronomical Union (IAU)
- **Member**, VERITAS Collaboration
- **Member**, Cherenkov Telescope Array Observatory (CTAO)

Teaching & Mentorship

Co-mentored the following students during postdoctoral appointments:

U. of Utah	**Eleanor Anne Young** (Undergraduate, now PhD student at Dalhousie University, Halifax, Nova Scotia, Canada) *Project:* Simultaneous *NuSTAR* and *Swift* observations of NGC 4278 | published ApJ 1006, 186, 2026
U. of Utah	**Kennedie Paige Wilding** (Undergraduate, now PhD student at UoU) *Project: Swift* observations of blazar VER J0521+211 | manuscript in preparation.
Warsaw PDF	**Alberto Floris** (now PhD student, IA-FORTH, Heraklion, Crete) *Project:* Dark and bright sides of the BLR clouds as seen in the Fe II emission of SDSS RM 102 | published A&A 697, A23, 2025
IIA PDF	**Siddarth Goyal** (Undergraduate, Shiv Nadar University) *Project:* X-ray flux variability in Narrow-line Seyfert-1 galaxies using *XMM-Newton*

Peer Review & Service

- Referee for international journals: **ApJS**, **ApJ**, **AJ**, **MNRAS**
- Reviewer for ***NuSTAR* Annual Observing Proposals**

Selected Conferences, Workshops & Seminars

Colloquia & Seminars

1. **Colloquium:** " VHE Observations of "Changing-Look Blazars " with VERITAS" — LHAASO Collaboration at IHEP, Beijing, China (August 2026)
2. **Colloquium:** "Unveiling Transitional Blazars: A Multiwavelength Approach" — IRyA, UNAM Morelia, Mexico (February 2025)
3. **Seminar:** "New theoretical Fe II templates for bright quasars" — ARIES, Nainital, India (September 2024)
4. **Colloquium:** "Iron Emission in Active Galactic Nuclei" — NAOC, Beijing, China (August 2024)
5. **Colloquium:** "New theoretical Fe II templates for bright quasars" — IHEP, Beijing, China (July 2024)

International Conferences & Workshops

1. **Oral:** "VERITAS Observations of Changing-look Blazars" — ICRC 2025, Geneva, Switzerland (July 2025)
2. **Poster:** "Broad-line region in AGN: Dusty or dustless?" — The Restless Nature of AGN: 10 Years Later, Naples, Italy (June 2023)

3. **Workshop:** Broadband Spectral and Timing Studies with AstroSat, Chandra and XMM-Newton (COSPAR Capacity Building Workshop) — IISER Mohali, India (March 2019)
4. **Oral:** "X-ray Intraday Flux and Spectral Variability of TeV Blazars with *NuSTAR*" — Half a Century of Blazars and Beyond, Torino, Italy (June 2018)
5. **Oral:** "X-ray Intra-day Variability of Five TeV Blazars with *NuSTAR*" — Wide Band Spectral and Timing Studies of Cosmic X-ray Sources, TIFR, Mumbai, India (January 2017)

National Conferences & Workshops

1. **Oral:** "Detection of minute-timescale γ-ray variability in BL Lacertae by *Fermi*-LAT" — 41st Annual Meeting of the Astronomical Society of India (ASI), IIT Indore (March 2023)
2. **Thesis presentation:** "Multi-wavelength Studies of TeV Blazars" — 38th ASI Annual Meeting, IISER Tirupati (February 2020)
3. **Oral:** "X-ray Intra-day Variability of Five TeV Blazars with *NuSTAR*" — RETCO-III, IIST Thiruvananthapuram, India (June 2017)
4. **Workshop:** AstroSat Data Analysis — Tezpur University, India (May 2017)

References

- **Prof Bozena Czerny** (Postdoc supervisor)
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- **Prof Alok C. Gupta** (Thesis-supervisor)
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