



Sapna Mishra

Space Telescope Science Institute (STScI)

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Research Interest:

• Galaxy evolution within the Local Group, • Study of the diffuse gas in and around the Magellanic systems, • Investigating the multiphase extremely diffuse gas in the outskirts of the galaxy clusters, • Gas inflow and outflow in and around the circumgalactic medium (CGM), • CGM of cluster galaxies to understand environmental effects such as ram-pressure stripping, overshooting, and pre-processing, • Strong outflows in the broad absorption line quasars and their blazar-like subclass, • Incidence rate (dN/dz) of intervening absorbers across different background sources, • Absorption line spectroscopy.

Academic Positions

Space Telescope Science Institute
Postdoctoral Fellow

Baltimore, USA
2023 - present

Inter-University Centre for Astronomy & Astrophysics
Postdoctoral Fellow

Pune, India
2021 - 2023

Aryabhata Research Institute of observational sciencES
Post Thesis Submission Fellow (PTSF)

Nainital, India
2020 - 2021

Education

Aryabhata Research Institute of observational sciencES
Ph. D

Nainital, India
2015 - 2020

- **Thesis:** Probing environment of AGNs based on their feedback processes
- **Advisor:** Prof. Hum Chand
- **Degree Awarded:** July 2021

Aryabhata Research Institute of observational sciencES
Pre-Ph. D Course work

Nainital, India
2014 - 2015

Department of Physics & Astrophysics, Delhi University
Master of Science, Physics and Astronomy

Delhi, India
2012 - 2014

Miranda House College, Delhi University
Bachelor of Science, Physics honors

Delhi, India
2012 - 2014

Highlights

- **Publication:** 8 first author publications, 14 total refereed publications since 2018, ~ 102 citations, h-index = 7.
 - **Media:** My recent study on the [CGM of the LMC](#) was featured in Jeopardy (American TV game show on 12-Feb-2025). This study was also highlighted in a [NASA press release](#) and covered by over five prestigious media outlets worldwide.
 - **Grants and observations:** PI of HST-Cycle 32 proposal (29 orbits, $\sim \$110K$), PI of VLT/FORS2 proposal, PI of more than 10 proposals for 2-4m class national ground based telescopes in India with observing experience of >50 nights.
 - **Selected Awards:** Awarded international prize fellowships such as: [FONDECYT-2023](#) Chilean Prize fellowship, and Research Grant type A2 in [MILANO-BICOCCA, 2022](#), Italy.
 - **Conferences and Workshops:** Presented my research at ~ 20 conferences worldwide and provided astronomical tool trainings at around five workshops.
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Telescope time and grants as Principle Investigator

- HST/COS, Cycle 32, “Probing the front-side of the Circumgalactic Medium of the Large Magellanic Cloud” (PID: GO-17757): 29 orbits
 - ESO/FORS2, Cycle P109, “MgII tomography of cluster outskirts using 11 background quasars” (PID: 109.23G6).
 - Devasthal Optical Telescope (DOT), 3.6m international telescope, India, DOT-2022-C1: “NIR spectroscopy of post-starburst galaxies to probe obscured star formation and stellar population” (PID: DOT-2022-C1-P18).
 - DOT, DOT-2021-C1, “Probing connection between the emission and absorption outflows in IR-bright BAL quasars”, PID: DOT-2021-C1-P32.
 - DOT, DOT-2018-C1, “Resolving the narrow emission line region of the quadruply imaged quasar: RXS J113155.4-123155” (PID: P325-2018A).
 - DOT, DOT-2017-C1, “Infrared properties of the jet dominated BALQSOs” (PID: P31-2017A).
 - Himalayan Chandra Telescope (HCT), 2m national telescope, India, HCT-2021-C2, “Probing the spectral variability of X-Ray bright high ionization Broad absorption line Quasars” (PID: HCT-2021-C2-P56).
 - HCT, HCT-2021-C1: “Intranight monitoring of blazar counter parts of BAL quasars (PID: HCT-2021-C1-P52).
 - HCT, 3 proposals in various cycles on “Probing environment of emerging Broad absorption line quasars” (PIDs: HCT-2020-C2-P27, HCT-2020-C1-P170, HCT-2019-C3-P117).
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Service

- Reviewed applications for Space Astronomy Summer Program (SASP)-2025 at STScI.
 - Co-Organize: HotSci, 2024, colloquium series at STScI.
 - Panel Support Scientist (PSS): moderated the TAC of HST Cycle, 32, JWST Cycle 3.
 - Served as a **service observer** at the Devasthal Optical Telescope (3.6m) during the COVID period, conducting observations on behalf of other proposers.
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Mentoring, Teaching and Outreach

- Co-mentoring undergraduate student, Zhibin You at John Hopkins University (JHU) (from Feb-10-2025- present).
 - Presented public talk at “Astronomy on Tab”, Baltimore, Jan-30-2025.
 - Given optical data reduction training in ARIES Training School in Observational Astronomy (AT-SOA), 2016, 2017, 2018, 2019, ARIES, Nainital, India.
 - Given high-resolution UVES spectra data reduction training in TMT workshop on large telescope data handling, Jan 15-27, 2017, IUCAA, Pune, INDIA.
 - Guided two master degree project students for the credit on the photometric and spectroscopic data reduction techniques during my Phd.
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Prize fellowships and Awards

- 2023: [FONDECYT-2023](#) Chilean Prize fellowship.
 - 2022: [MILANO-BICOCCA, 2022](#), Italy, Research Grants type A2.
 - 2014: All India “Graduate Aptitude Test in Engineering” (GATE), India.
 - 2012: All India “Joint Admission Test for Master (JAM)”, India
 - 2012: Selected as top 10% graduate level student in Delhi University.
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Technical and Software experience

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| • Observing Experience | > 50 nights with 2-4m ground based Indian telescopes. |
| • Operating System | Linux: Ubuntu, Fedora; MACOS, Windows |
| • Programming Languages | Python, IDL, C, C++, ecl-IRAF script, Unix Shell-Scripts |
| • Web programming | Php, mysql, HTML |
| • External Plotting Tools | Supermongo, GNUPLLOT |
| • Other Astronomy software | IRAF, DAOPHOT, CLOUDY, Topcat, Esorex, Gasgano, vpfitt |
| • Written big dataset SQL casjob queries for | SDSS, HST-MAST, SIMBAD, NED |
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Scientific Talks

- ACP, Aspen, “Holistic picture of CGM”, September 2024.
 - CfA, Harvard, “Multiphase Madness”, August 2024.
 - Space Telescope Science Institute, “Spring Symposium”, April 2024.
 - Flatiron Institute, “Milky Clouds over Manhattan”, February 2024.
 - Space Telescope Science Institute, “Galaxy/AGN Journal Club”, January 2024.
 - Space Telescope Science Institute, “CoolSci”, January 2024.
 - IUCAA, India, “Galactic inflows and outflows on all Scales”, February 2023
 - Università Milano-Bicocca, Milan, “What matter(s) around galaxies”, September 2022
 - IUCAA, India, “Monthly Last Friday Talk series”, January, 2022
 - IISER, Tirupati, India, “Astronomical Society of India”, Poster, March 2020.
 - Department of Physics & Astrophysics, Delhi University, “Departmental Talk”, October 2019.
 - IUCAA, India, “Recent Trends in the study of Compact Objects Theory and Observations (RETCO-IV)”, Poster, April 2019.
 - Institut d’Astrophysique de Paris(IAP), Paris, FR, “massive black holes in evolving galaxies: from quasars to quiescence”, Poster/Flash Talk, May 2018.
 - Département d’Astrophysique, Géophysique, Université de Liège, Liège, Belgium, December 2017.
 - ARIES, India, “ARIES Training School in Observational Astronomy (ATSOA)”, March 2018, March 2017, February 2016.
 - ARIES, India, “Tuesday Seminar series”, February 2017.
 - IUCAA, India, “Thirty Meter Telescope (TMT) Conference”, January 2017.
 - ARIES, India, “Belgo-Indian Network for Astronomy and Astrophysics (BINA)”, Poster/Flash Talk, November 2016.
 - ARIES, India, “Tuesday Seminar series”, May 2016.
 - IUCAA, India, “Cloudy Workshop”, September 2015.
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Workshops and Schools

- AstroSat data analysis workshop, August 8-11, 2017, ARIES, Nainital, India
 - TMT workshop on large telescope data handling, Jan 15-27, 2017 , IUCAA, Pune, India
 - Extragalactic Relativistic Jets: Cause and Effect, FERMI satellite data reduction school, ICTS Bangalore; October 14-21, 2015
 - Cloudy workshop, Sept 21-26, 2015, IUCAA, Pune, India
 - Workshop on the radio data reduction, Radio Astronomy School-2015 (RAS), August 31, 2015, NCRA, Pune, India
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Detailed multi-wavelength Research Experience

§1. Optical Astronomy:

- **Spectroscopy:**

- Extensive observational experience as Principal Investigator (PI) with national and international telescopes, including the [3.6m Devathal Optical Telescope](#) (DOT, India), [2m Himalayan Chandra Telescope](#) (HCT, India), [2.4m Lijiang Astronomical Observatory](#) (CAS, China), [6m Special Astrophysical Observatory](#) (SAO, Russia), and [8m European Southern Observatory](#) (ESO)/FORS2 for quasar absorption line studies
- Skilled in advanced data reduction and analysis using [IRAF](#), [ESOREX](#), [ESO-GASGANO](#), and [LPIPE](#) (IDL). Developed automatic data reduction pipelines in Python, [ec1-IRAF](#), [ESOREX](#)+UNIX script for various spectrographs mentioned above.
- Proficient in handling large (>100,000 quasars) archival spectra from facilities: [Sloan Digital Sky Survey](#) (SDSS), ESO (UVES, FORS1/2, X-SHOOTER), and Keck Observatory/LRIS, covering a wide spectral resolution range (900–40,000).
- Developed multiple GUI-based automation tools for quasar continuum fitting and identification of doublet absorption lines (MgII, CIV), and simultaneous emission and absorption spectral fitting.

- **Photometry:**

- Conducted observational AGN variability studies using ground-based [1-4m class national telescopes](#) at ARIES, Nainital, India.
- Performed differential photometry using [IRAF](#) and [DAOPHOT](#) for continuum variability studies and developed automatic data reduction and photometric analysis pipeline in IDL (Interactive data language).
- Developed astrometry correction pipeline (in python) for the mock dataset for the 4m international liquid mirror telescope (ILMT), ARIES, Nainital, India.

§2. Ultraviolet (UV) Astronomy:

- Principal Investigator (PI) for **Hubble Space Telescope / Cosmic Origins Spectrograph (HST/COS) Cycle-32** proposal.
- Handled large HST datasets of quasar spectra from the [Hubble Spectroscopic Legacy Archive](#) (HSLA), developing automated Python tools for spectral addition, continuum fitting, and line identification.
- Conducted photoionization modeling using [Cloudy](#) and absorption line modeling using [vppfit](#) to analyze diffuse gas in cluster outskirts and the circumgalactic medium (CGM).
- Experienced in [AstroSat-UVIT](#) satellite data reduction and [LAXPC](#) data analysis (trained in a dedicated data reduction workshop, ARIES, Nainital, 2017).

§3. **X-ray Astronomy:** Expertise in Chandra and XMM-Newton satellite data reduction and spectral modeling using [Xspec](#) (submitted proposals), focusing on shielding gas in X-ray bright BAL quasars (trained through a dedicated data reduction workshop).

§4. **Radio and γ -ray Astronomy:** [GMRT](#) data reduction using [AIPS](#) and [CASA](#) (trained in a dedicated data reduction workshop, RAS, NCRA, Pune, 2015) and FERMI satellite data reduction using [FERMI-LAT](#) and high-energy astrophysical analysis (trained in a dedicated data reduction workshop, ICTS, 2015).

List of publications

First-author publications

- §8. **Mishra, Sapna**; Fox, Andrew; Smoker, J; Lucchini, Scott; D’Onghia, Elena; 2025, ApJ (under revision), *“The Distance to the Magellanic Stream: Constraints from Optical Absorption along Stellar Sightlines”*.
- §7. **Mishra, Sapna**; Fox, Andrew; Krishnarao, Dhanesh; Lucchini, Scott; D’Onghia, Elena; Cashman, Frances; Barger, Kathleen; Lehner, Nicolas; Tumlinson, Jason, 2024, ApJ Letters, 976, L28, *“The Truncated Circumgalactic Medium of the Large Magellanic Cloud”*
- §6. **Mishra, Sapna**, Muzahid Sowgat, Dutta Sayak, Srianand, Raghunathan, Charlton, Jane, 2024, MNRAS, 527, 3858, *“Characterizing cool, neutral gas, and ionized metals in the outskirts of low- z galaxy clusters”*.
- §5. **Mishra, Sapna**, & Muzahid Sowgat, 2022, ApJ, 933, 229, *“Discovery of a Cool, Metal-rich Gas Reservoir in the Outskirts of $z \approx 0.5$ Clusters”*.
- §4. **Mishra, Sapna**, Gopal-Krishna, Chand H., Chand K., Kumar A., Negi V., 2021, MNRAS Letters, 2021, 507, 46, *“A search for blazar activity in broad-absorption-line quasars”*.
- §3. **Mishra, Sapna**, Vivek M., Chand H., Joshi R, 2021, MNRAS, 504, 3187, *“Appearance versus disappearance of broad absorption line troughs in quasars”*.
- §2. **Mishra, Sapna**, Krishna G, Chand H, Chand K, Ojha V, 2019, MNRAS Letters, 489, L42, *“Are there broad absorption line blazars?”*.
- §1. **Mishra Sapna**, Chand H, Krishna G, Joshi R., Shchekinov Y. A., Fatkhullin T. A., 2018, MNRAS, 473, 5154, *“On the incidence of MgII absorbers along the blazar sightlines”*.

Co-author publications [†]

- §5. Dutta, Sayak; Muzahid, Sowgat; Schaye, Joop; **Mishra, Sapna**; Chen, Hsiao-Wen; Johnson, Sean; Wisotzki, Lutz; Cantalupo, Sebastiano, 2024, MNRAS, 528, 3745, *“MUSEQuBES: mapping the distribution of neutral hydrogen around low-redshift galaxies”*.
- §4. Gopal-Krishna, Chand K., Chand H., Negi V., **Mishra, Sapna**, Britzen S., Bisht S., 2023, MNRAS, 518, 13, *“Intranight optical variability of low-mass active galactic nuclei: a pointer to blazar-like activity”*.
- §3. Kumar B., Negi V., Ailawadhi B., **Mishra, Sapna**, Pradhan B., Misra K., Hickson P., Surdej J., 2022, JAA, 43, 10, *“Upcoming 4m ILMT facility and data reduction pipeline testing”*.
- §2. Chand K., Gopal-Krishna, Omar A., Chand H., **Mishra, Sapna**, Bisht S., Britzen S, 2022, MNRAS, 511, 13, *“Intranight variability of ultraviolet emission from powerful blazars”*.
- §1. Ojha V., Chand H., Gopal-Krishna, **Mishra, Sapna**, Chand, K, MNRAS, 2020, 493, 3642, *“Comparative intra-night optical variability of X-ray and γ -ray detected narrow-line Seyfert 1 galaxies”*.

[†]: provided data analysis codes and mentored first authors in their application.

Conference Proceedings & GCN Circular

- §4. Kumar, Amit; Gupta, Rahul; Dastidar, Raya; Dimple; Ghosh, Ankur; **Mishra, Sapna**; et al. 2020GCN.29030....1K, *“GRB 201203A: 1.3m DFOT, optical upper limits”*.
 - §3. Kumar A., Aryan, A., Pandey S.B., **Mishra, Sapna**; et al. 2020GCN.27564....1K, *“GRB 200412B: Optical afterglow detection with 1.3m DFOT”*.
 - §2. **Sapna Mishra**, H. Chand, et al. 2018, Bulletin de la Société Royale des Sciences de Liège, 87, 325, *“Revisiting the incidence of Mg II absorbers along the blazar sightlines”*.
 - §1. Hum Chand, Suvendu Rakshit, Priyanka Jalan, Vineet Ojha, Raghunathan Srianand, Mariappan Vivek, **Sapna Mishra** et al. 2018, Bulletin de la Société Royale des Sciences de Liège, 87, 291, *“Probing the central engine and environment of AGN using ARIES 1.3-m and 3.6-m telescopes”*.
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