TANMAY SINGH

Third Year Ph.D. Student | Arizona State University
Phone : +1 480 246 4702 | Email : tsingh65@asu.edu | LinkedIn | GitHub

Education

Arizona State University — Aug 2023 - Present
SESE, PhD in Astrophysics — **CGPA: 4/4**

Indian Institute of Technology, Delhi — July 2019 - July 2023
Bachelor of Technology, Engineering Physics — **CGPA: 8.51/10.0**

Publications

- **Singh, T.**, Aryan Singh, R., Koike, F., Iizawa, M., & Azuma, Y. (2025), "Scattering Angle Dependence of Fano Resonance Profiles in Cold Atomic Collisions Analyzed with the Complex Valued w Parameter," *arXiv e-prints*, arXiv:2507.17674.

Scholastic Achievements

- **Summer Exploration Graduate (SEG) Fellowship** : by School of Earth and Space Exploration, ASU 2024
- **PanIIT USA Graduate Scholarship** 2023
- **Summer Undergraduate Research Award**:For exemplary results of a project on Quantum Key Distribution 2021

Research Experience

O VI in the Intra-group Medium from SIMBA and IllustrisTNG — Aug 2023 – Present
***Graduate Research**, School of Earth and Space Exploration, Arizona State University*
Supervisor: Prof. Sanchayeeta Borthakur

- Compare O VI absorption predicted by cosmological simulations (SIMBA, IllustrisTNG) with COS-IGrM observations using synthetic quasar spectra.
- Performing XGBoost-based analysis to identify key physical drivers (e.g., halo mass, impact parameter, stellar mass) of detectability.
- Draft paper prepared; results to be presented at AAS 2026.

Spectral Classification of AGN and Supernovae with BLOG — Jan 2024 – Present
***Graduate Research**, School of Earth and Space Exploration, Arizona State University*
Supervisors: Prof. Siddharth Srivastava and Prof. Rolf Jansen

- Developing a contingent Bayesian-logic (BLOG) model to classify AGN and Supernovae spectra using emission-line detections, widths, and ratios.
- Incorporated dust attenuation and variability models; built line-fitting and identification pipeline to inform priors.

Kinematics of the Outer Circumgalactic Medium in IllustrisTNG — Aug 2024 – Present
***Graduate Research**, School of Earth and Space Exploration, Arizona State University*
Supervisor: Prof. Sanchayeeta Borthakur

- Investigating co-rotation and counter-rotation of outer CGM gas around $L^\star$ galaxies using sightline-based synthetic spectroscopy in TNG50-1.
- Produced ∼75,000 spectra for Lyα, C II λ1334, and Si III λ1206; conducting kinematic classification and uncertainty analysis.

Preliminary site quality analysis for an Indian sub-millimeter Telescope — May 2022 – Jul 2022
***Visting Research Intern**, Astronomy and Astrophysics Dept, Raman Research Institute*
Supervisor : Prof. Mayuri S. Rao, Astronomy and Astrophysics Dept, RRI

- Found prospective sites in the Ladakh region for an Indian sum-mm/ THz 6-m telescope to be established by Indian Space Research Organisation(ISRO)
- Used global PWV and other data sets from NASA,ECMWF to establish the quality of sites in Ladakh region
- Used pandas, NumPy, SciPy, matplotlib, QGIS as major tools. Currently working for the publication of results.

Magnetic field Topology and Properties of Solar Coronal lines July 2022 – June 2023

Senior Thesis Project

Supervisor : Prof. Suprit Singh, Physics Dept. , IIT Delhi

- Cleaned and aligned images from the Total Solar Eclipse(2017) using phase correlation and unsharp masking
- The magnetic field's theoretically predicted closed/open lines were retrieved using methods like RHT and ACF
- Aim to check and verify the magnetic field topology thus obtained with Magneto-Hydrodynamics(MHD) equations

Post-Processing and Applications in Quantum Secure Communication May 2021 – Dec 2021

Semester Project, Summer Undergraduate Research Award(SURA)

Supervisor : Prof. Bhaskar Kanseri, Department of Physics, IIT Delhi

- Selected for SURA '21, out 27 entries in Physics and Electrical Department in IIT Delhi through research proposal and interview.
- Developed an optimized software to realize the Post- Processing in Quantum Key Distribution using entanglement with experimental verification via lab data from photonics lab in IIT Delhi
- Multiple reconciliation algorithms with varieties of cascade algorithm and privacy amplification algorithms implemented along with networking in Python

Angular Dependence of Fano Profile in Ultra Cold Atomic Collision Mar 2022 – April 2023

Supervisors: Prof Fumihiro Koike, Department of Physics, Sophia University
Prof. Yoshiro Azuma, Department of Physics, IIT Delhi

- Studied Fano Profiles in cold Atomic Collisions like H-Kr and the dependence of Fano Parameter with scattering angle
- Used python and code ocean for programming and calculations. Working on compilation of results for publication

Competitive Research

- **International Theoretical Physics Olympiad** | **Rank 12** (out of 276 teams) Jan 2021
- **The University Physics Competition** | **Silver Medal** (top 12 out of 340 teams) Nov 2020
  - *Ion Thrusters to Saturn* : Calculation and analysis of the optimal path in terms of fuel consumption and time required to reach Saturn with Ion Thruster as the main propulsion system . Implemented gravity assists in model for Paramater optimization
  - **Paper:** Compiled the analysis and proposed solutions in a research paper within 48 hrs
- Preliminary **discovery of 3 asteroids** under DST-IASC Asteriod Search Campaign Jan 2022 – Feb 2022

Technical Skills

Programming: Python (primary), Julia (basic), Java (BLOG), Scala/sbt, C/C++, MATLAB, Bash; SQL: MySQL
Scientific/Analysis: NumPy, SciPy, pandas, xarray, h5py, netCDF4, Astropy, statsmodels, lifelines
Astronomy & Simulation:yt, Trident, PyGAD/pygadgetreader, scida, AM (radiative transfer), CASA (radio/mm), CFITSIO, FFTW, WCSlib
ML/Inference:scikit-learn, XGBoost; Bayesian Logic (BLOG) modeling; gradient boosting, class-imbalance handling
Parallel/HPC:SLURM (job arrays), mpi4py/MPI, multiprocessing, SSH/X11, Globus; HDF5/parallel I/O workflows
Geospatial/Remote Sensing:QGIS, GDAL, rioxarray, cartopy, PROJ; ERA5/ECMWF data handling
Visualization: Matplotlib, yt, Gnuplot.
Dev/Build & Env: Git/GitHub, Docker, conda/mamba, uv, pyenv/virtualenv, sbt; VS Code, Sublime Text, LaTeX
File Formats:HDF5, FITS, NetCDF, CSV/Parquet

Relevant Coursework

Graduate-Level (Arizona State University): An Introduction to Astro-Statistics, Stars and the Interstellar Medium, Galaxies and Cosmology I, Cosmic Ecosystems, SESE Colloquium, SESE Knowledge Exploration, Advanced Radio Astronomy (in progress).
Undergraduate-Level (IIT Delhi): Classical Mechanics and Relativity, Quantum Mechanics, Particle Accelerators, Electrodynamics, Statistical and Mathematical Physics, Optics and Photonics I–II, Solid State Physics I–II, Superconductivity and Its Applications.
Labs: Applied Optics (2 semesters), Solid State Physics (2 semesters), Chemistry (1 semester), Digital Electronics (1 semester).
Other: Calculus, Linear Algebra and Differential Equations, Signals and Systems, Engineering Mechanics, Chemical Synthesis of Functional Materials

Teaching and Presentations

- **Poster Presentation, URSSI Summer School for Open Science** Aug 2025
  Presented a poster on *Enhancing Synthetic Absorption Spectroscopy Capabilities for Large AREPO-based Cosmological Simulations* at the URSSI Summer School for Open Science.
  Attended the associated workshop sessions on reproducibility, data sharing, and open-source research workflows.
- **Teaching Assistant, AST 121: Introduction to Astronomy Laboratory** Spring 2025
  School of Earth and Space Exploration, Arizona State University.
  Taught and supervised three lab sections; responsibilities included giving lectures, grading, and assisting students with telescope-based experiments and night-sky observations.
- **VSM Research Presentation**: Raman Research Institute Jul 2022
  Presented research on *Preliminary Site Quality Analysis for an Indian Sub-millimeter Telescope* at RRI Auditorium to faculty members and doctoral students.
- **Looking at the Sky through Radio Eyes: 21-cm Cosmology**, Student Lecture: IIT Delhi Sep 2022

Observing Experience

- **Co-PI, 12m Telescope (AZ)** Oct - Nov 2023
  - Connecting Molecular Gas to the Circumgalactic Medium in Nearby Galaxies
  - Time Awarded: 51 hours to obtain CO(1-0) observations
- **Co-PI, Hectochellle (AZ)** Sep 2023
  - Unveiling the Hidden Disks of Nearby Galaxies

Additional Experience

- **International Student Advocate, SESE Graduate Council** Aug 2025 – Present
  - Represent international graduate students in the School of Earth and Space Exploration (SESE).
  - Coordinate with other council members to organize events, enhance student engagement, and promote inclusion within SESE.
- **Campus Ambassador,** Spaceonova Jul 2020 – Aug 2020
  - Promoted the importance of space education through digital platforms and campus outreach.
  - Managed outreach programs and encouraged 10+ students to participate in workshops and astronomy mini-projects.
- **Member,** Cycles Remote Innovation Program *: Supervised by Prof. Bryan Cassady* Jul 2020
  - Collaborated on innovation and marketing model design with an international team.
  - Delivered the project on time and received the Best Team Award for the July 2020 cohort.
- Participated in the **Galactic Rotation Workshop, Pravega '21** conducted by IISc Bangalore Oct 2020