Sohaib Ali

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nebula-navigator.github.io

Research Interests I am interested in developing new techniques to analyze observational data from space as well as ground based telescopes in order to maximize the yield of information from data. With interests spanning exoplanet characterization, binary stars, black holes in globular clusters, and fundamental questions like the search for life beyond Earth, I aim to develop tools that push observational boundaries. As observational data grows, my goal is to leverage advanced techniques, including machine learning and AI, to enhance data interpretation and accuracy of information.

Education

MSc Physics and Astronomy — Oct 2023 – Aug 2025
Nicolaus Copernicus University, Torun, Poland

BSc Space Science (4 years) — Sep 2017 – Aug 2021
Institute of Space Technology, Pakistan
Majored in Astronomy & Astrophysics

Dissertation (Master)

"Exoplanet Atmospheric Retrievals Using TauRex" — Oct 2024 - Present
under supervision of Professor Andrzej Niedzielski

Research Collaborations

Tarleton Exoplanet Transit Search Program — Feb 2023 - Present
Mentored by Dr. Shaukat Goderya

- Analyzing photometric data from the Tarleton Observatory.
- Conducting searches for candidate exoplanets and stellar binaries.

Research Experience

Star Cluster Dynamics and Black Hole Growth — July 2024 - November 2024
Nicolaus Copernicus Astronomical Center, Warsaw
Studentship under POLONIZ grant
Mentored by Dr. Abbas Askar

- Developed a python-based pipeline to analyze MOCCA simulation data
- Growth of Intermediate-Mass Black Hole Seeds in Dense Star Clusters: Tidal Disruption Events, Eccentric Gravitational Wave Mergers, and Light Intermediate-Mass Ratio Inspirals
- Observational Properties of Star Clusters Hosting Intermediate-Mass Black Hole: Distribution of Stars and Binaries IMBHs and Creating Mock Photometric Observations from Simulations

Tarleton Exoplanet Transit Search Program (BSc. Dissertation) — 2020-2021
Tarleton State University in collaboration with IST, Islamabad

- Photometric data acquisition and analysis of CoRoT 10263870b.
- Modeled light curves using AstroImageJ, PyTransit, and PHOEBE.

Publications in Preparation

Author(s): Sohaib Ali, Abbas Askar
Title: "Growth of Intermediate-Mass Black Hole Seeds in Dense Star Clusters: Tidal Disruption Events, Eccentric Gravitational Wave Mergers, and Light Intermediate-Mass Ratio Inspirals"
Status: In preparation for submission to *Astronomy and Astrophysics*
Expected Submission: December 2024

Author(s): Sohaib Ali, Abbas Askar, Paolo Bianchini
Title: "Observational Properties of Star Clusters Hosting Intermediate-Mass Black Hole: Distribution of Stars and Binaries around IMBHs and Creating Mock JWST Photometric Observations from Simulations"
Status: In preparation for submission to *Astronomy and Astrophysics*
Expected Submission: December 2024

Author(s): Sohaib Ali, Dr. Shaukat Goderya
Title: "New Eclipsing Binary in TESS and ATLAS FOV"
Status: In preparation
Expected Submission: July 2025

Conferences

Modeling and Observing DEnse STeller systems (MODEST) Aug 2024
Nicolaus Copernicus Astronomical Center, Warsaw
Volunteered and attended as part of local organising team

International Conference on Space (ICS) March 2022
Space and Upper Atmosphere Research Commission (SUPARCO), Islamabad

Poster Presentations

Ali, S., "Photometric Analysis of COROT 102638570 System"
Presented at ICS 2022

Astronomy Training

International School for Regional Young Astronomers Dec 2023
Chinese Academy of Sciences, Yunnan Observatories
Training in asteroseismology, extrasolar planets, photometry, and spectroscopy.

Teaching Experience

Physics Teacher, Hussain Public School, Rawalpindi Nov 2022 – Jan 2023

Physics Tutor, Prepcore Tutoring, Texas Oct 2021 – Feb 2022

Observatory Experience

IST Observatory, Islamabad 2020-2021
Operated two optical telescopes, including the largest in Pakistan.

Job Experience

AI Training Engineer at Darvis Inc., Feb 2023-Nov 2023
Training computer vision and customized AI models for commercial use.

Scholarships, Honors & Awards

Rector's Scholarship, Nicolaus Copernicus University 2024-2025
Studentship under POLONIZ Grant of Dr. Abbas Askar Jul 2024-Nov 2024
Excellence Initiative Scholarship, Nicolaus Copernicus University 2023-2024

Preliminary Asteroid Discovery, IASC 2022
NASA Space Apps Challenge (Regional Winner) 2019

Outreach

President, Space Society IST 2020-2021
Promoted astronomy awareness through national outreach programs.

Skills

- **Programming**: C++, Python
- **Software**: MS Office, MATLAB, Jupyter Notebooks, Registax, Astrometrica
- **Astronomy codes**: Developed MOCCA-BH-Forge, Proficiency in Astro Image J, VaST, Allesfitter, Physics of Eclipsing Binaries (PHOEBE), MESA, REBOUND, Stellarium, Astrometrica, C-Munipack, IRAF , N-body simulation codes like MOCCA and Piernik, working with TauRex as part of my master dissertation
- **Archival data handling**: Mikulski Archive for Space Telecopes (MAST), SIMBAD, Exoplanet Archive
- **Python Libraries (astronomy)**: Pytransit, Eleanor, Lightkurve, Astropy, PyAstronomy, Matplotlib, Seaborn , Scripting for Data Processing and Analysis
- **OS**: Windows, Linux
- **Github**: nebula-navigator
- **Machine Learning and AI**: Developing computer vision models for image classification using tools such as YOLO (ultralytics) and frameworks like Keras, Tensorflow and PyTorch, Preparing data and training Machine Learning and AI models for commercial use.