Javed Iqbal

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Education

- **M.S. in Astronomy and Astrophysics** *2019 – 2023*
  Institute of Space Technology (IST), Islamabad, Pakistan
  Thesis: Photometric Search for Jupiter-Sized Short-Period Exoplanets in Open Clusters NGC 884 and NGC 869
  Supervisors: Dr. Shaukat Goderya (Professor) and Dr. Fazeel Mahmood Khan (Professor)
  CGPA: 3.24 / 4.00

- **B.S. in Physics** *2015 – 2019*
  Bahauddin Zakariya University (BZU), Multan, Pakistan
  Final Year Project: Comparative Analysis of Habitable Zones around M-Dwarf Systems
  Supervisor: Dr. Hafiz Tariq Masood (Assistant Professor)
  CGPA: 3.60 / 4.00

Research Interests

Detection and characterization of exoplanets; transit photometry; planetary atmospheres; emission and absorption spectroscopy; and habitability studies.

Research Experience

- **Research Collaborator**
  ÇOMÜ Ulupınar Observatory, Turkey
  Project: Transit Timing Variation Analysis for Additional Planet Detection around Short-Period Systems
  Summary: In collaboration with Mehmet Yüksek, led an investigation of transit timing variations (TTVs) in three short-period planetary systems to identify additional planets. Developed a custom Python pipeline for precise transit-timing analysis, integrating MCMC fitting and N-body simulations to constrain potential perturbers. Combined new observations from the ÇOMÜ Ulupınar Observatory with archival data to model the gravitational effects of unseen companions. Ongoing observational campaigns and preliminary analysis are in progress.

- **Master's Thesis**
  Institute of Space Technology, Islamabad, Pakistan
  Title: Photometric Search for Jupiter-Sized Short-Period Exoplanets in Open Clusters NGC 884 and NGC 869
  Summary: Performed a photometric survey of open clusters NGC 884 and NGC 869 using the 0.8 m telescope at Tarleton State University. Extracted light curves with ISIS and VaST pipelines and analyzed them using custom Python scripts. Although no transits were detected, identified 25 variable stars, including four newly reported candidates. Periods were determined using NASA's Periodogram Service and the Lightcurve Analysis Tool.

- **Independent Project**
  Detection and Kinematic Analysis of Galactic HI 21 cm Emission Using a Small-Aperture Radio Telescope
  Summary: Conducted 600 s drift-scan observations with the 1.5 m PICTOR telescope to detect and model Galactic H I emission. Performed RFI mitigation, Gaussian profile fitting, and LSR velocity derivation using a custom Python pipeline. Achieved column densities consistent within 15% of the LAB survey, confirming calibration accuracy.

- **Deep Space Initiative (DSI)**
  Neuro-Responsive Regenerative Window Systems for Modular Space Habitats
  Summary: Modeled thermo-mechanical behavior of adaptive self-healing materials for future

space habitats using COMSOL and ANSYS. Co-authored the final research report proposing an AI-driven Neuro-Responsive Regenerative Window System (NRWS). Established TRL-4 validation through finite element simulations under orbital loading conditions.

Projects

- **Exoplanet Transit Simulator** *Open-Source Web Application*
  https://Jiqbal-astro.github.io/exoplanet-transit-simulator
  Summary: Developed an interactive JavaScript-based simulator to model exoplanet transits, generate synthetic light curves with limb-darkening, and analyze habitable-zone limits using stellar parameters. Implemented Keplerian orbit dynamics, multi-planet configurations, and built-in real exoplanet data (e.g., TRAPPIST-1e, Kepler-186f, Proxima b) for comparative analysis.

- **Lunar & Planetary Phase Simulator** *Open-Source Web Application*
  https://Jiqbal-astro.github.io/lunar-planetary-phase-simulator/
  Summary: Created a browser-based simulator for visualizing lunar and planetary illumination phases and reflected-light curves. Built as a single-page JavaScript tool featuring real-time Lambertian disk rendering, date-linked lunar phases, and adjustable orbital parameters (inclination, eccentricity, albedo, R_p/a). Includes live phase-curve plotting, preset systems (HD 209458 b, 51 Peg b, Kepler-10 b), and export options for PNG and CSV.

Publications

Peer-Reviewed Articles

- **J. Iqbal**, S. Goderya, and F. Mahmood Khan, *Photometric Search for Short-Period Jupiter-Size Exoplanets in the Open Clusters NGC 884 and NGC 869, Open European Journal on Variable Stars*, vol. 256, pp. 1–15, 2024. ISSN: 1804-6932. DOI: 10.5817/OEJV2024-0256.

- **J. Iqbal**, *New Transit Analysis of WASP-10b: A Study with Exoplanet Watch,* in New Astronomy, 2025.

- **J. Iqbal**, *Detection and Kinematic Analysis of Galactic HI 21 cm Emission Using a Small-Aperture Radio Telescope, Zenodo*, 2025. DOI: 10.5281/zenodo.17420622.

Popular Science Writing

- **J. Iqbal** (2025). *Are We Alone? The Search for Life in a Vast Universe. Scientia Magazine, Pakistan.* [Read Online]

- **J. Iqbal** (2025). *Light Pollution and the Fading Night Sky. Dawn News, Pakistan.* [Read Online]

Presentations

Poster Presentations

- **Photometry and Transit Modeling of the Exoplanet TOI-2109b** (Link) *24 Jul 2024*
  Presented at the *Sagan Summer Hybrid Exoplanet Workshop*, organized by the NASA Exoplanet Science Institute (NExScI), California Institute of Technology (Caltech).

- **Determining the Parameters of Open Clusters NGC 884 and NGC 869 Using Gaia EDR3** (Link) *02 Feb 2024*
  Presented at the *International Conference on Relativistic Astrophysics and Cosmology (ICRAC-24)*, COMSATS University Islamabad, Lahore Campus.

Invited Talks

- **Life Beyond Earth: How Close Are We to Finding It?** *12 May 2025*
  Astronomy and Astrophysics Chapter, Pakistan.
- **Exoplanets: Paving a Way to Search for Alien Life** *24 Oct 2024*
  World Space Week Seminar, National University of Sciences and Technology (NUST), Islamabad.
- **Search for Short-Period Jupiter-Size Exoplanets in Open Clusters NGC 884 and NGC 869** *09 Oct 2023*
  World Space Week Seminar, National University of Sciences and Technology (NUST), Islamabad.
- **Exoplanet Detection through Transit Photometry** *25 Nov 2022*
  Master Research Seminar, Institute of Space Technology (IST), Islamabad.

Technical Skills

Programming & Data Analysis

- **Languages:** Python, Bash, Git
- **Libraries:** NumPy, Pandas, SciPy, Astropy, Matplotlib, Seaborn
- **ML & Statistical Methods:** Gaussian Mixture Modeling (scikit-learn), Markov Chain Monte Carlo (emcee), Kernel Density Estimation (KDE), and Bayesian inference

Astronomical Software

- **Data Reduction:** IRAF, ISIS, VaST, FITSH, AstroImageJ, EXOTIC
- **Transit Analysis:** PyTransit, VARTOOLS, Allesfitter, PHOEBE, Batman

Observational Astronomy

- **Telescope Operation:** 16-inch Cassegrain (IST), 0.8 m Ritchey–Chrétien (TSU)
- **Observation Planning:** Skilled in designing and executing photometric observation campaigns
- **Data Collection:** Experience with photometric and basic spectroscopic observations

Professional Development

- 2024 Sagan Exoplanet Summer Hybrid Workshop on *Advances in Direct Imaging: From Young Jupiters to Habitable Earths* (Jul 24-28)(Virtual)
- 2023 Sagan Exoplanet Summer Hybrid Workshop on *Characterizing Exoplanet Atmospheres: The Next Twenty Years* (Jul 24-28)(Virtual)
- Europlanet Summer School on *Ground-based observations and science communication* (8-18 Aug 2023)(Virtual)
- Workshop on *General Relativity, Cosmology, and Astrophysics* organized by the Institute of Space Technology, Islamabad
- Webinar on *Two-fluid plasma model for generation of seed magnetic fields and astrophysical jets* Organized by COMSTECH, Islamabad
- The 4th Abdus Salam Memorial Lecture on *The Time of Your Life* by Dr. Robert L. Jaffe (2018) at Lahore University of Management Sciences (LUMS), Lahore, Pakistan

Work Experience

- **Remote Research Intern** *May 2025 – Present*
  Deep Space Initiative (DSI), USA
  Contributing to the Space Architecture Program on adaptive self-healing materials for modular habitats. Focused on thermo-mechanical modeling using COMSOL/ANSYS and system-level design integration.

- **Physics Lecturer** *Mar 2024 – Oct 2024*
  Government Graduate College for Boys, Chichawatni, Pakistan
  Taught undergraduate-level Physics courses, supervised student projects, and conducted practical laboratory sessions emphasizing mechanics, electromagnetism, and optics.

- **Physics Lecturer** *Feb 2023 – Jan 2024*
  STEM College, PWD Campus, Islamabad, Pakistan
  Delivered lectures in Physics for intermediate students, developed lab manuals, and integrated technology-assisted learning methods into course instruction.

Honors and Awards

- **Preliminary Asteroid Discovery,** *International Astronomical Search Collaboration (IASC)*
  Recognized for identifying a preliminary asteroid candidate during an international citizen-science campaign. [IASC Website]

- **Academic Excellence Award,** *Prime Minister's Youth Laptop Scheme (PMYLS)*
  Awarded for outstanding academic performance among top university students. [PMYLS Website]

- **Merit-Based Academic Scholarship,** *Department of Physics, Bahauddin Zakariya University (BZU), Multan*
  Received for consistently ranking in the top 5% of the undergraduate physics program.

- **3rd Position,** *Project Presentation Competition, Department of Physics, BZU, Multan*
  Secured third place for presenting an undergraduate research project on habitable zones around M-dwarf stars.

Online Courses (MOOCs)

- **NASA's Open Science 101** by Dr. Nicola Fox, NASA.
- **The Diversity of Exoplanets** by Prof. Stéphane Udry, Prof. Michel Mayor, and Prof. Didier Queloz, *Université de Genève.*
- **Programming for Everybody (Getting Started with Python)** by Prof. Charles Severance, *University of Michigan.*
- **Project Management: Initiating and Planning Projects** by Prof. Margaret Meloni, *University of California, Irvine.*
- **Philosophy of Science** by Prof. Michael Weisberg, *University of Pennsylvania.*
- **Introduction to Machine Learning** by Prof. Lawrence Carin, *Duke University.*
- **Hertie Data Science Summer School** *Hertie School, Berlin.*

Professional Affiliation

Member, American Association of Variable Star Observers (AAVSO)
https://www.aavso.org/users/jiqbal *2023 – Present*

References

- **Dr. Shaukat Goderya, Professor**
  Director, Programs for Astronomy Education and Research
  Tarleton State University (TSU), Texas, USA
  Email: goderya@tarleton.edu

- **Dr. Fazeel Mahmood Khan, Professor**
  Center for Astrophysics and Space Science
  New York University Abu Dhabi (NYU-AD), United Arab Emirates
  Email: fmk5060@nyu.edu

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