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Malaika Malik

Astrophysics & AI Researcher
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SUMMARY

Astrophysics and Cognitive Science researcher applying machine learning to space science and scientific imaging. Lead of the largest international CubeSat capacity-building study (**IAC 2025 oral presentation**). Developed **ESA-grade comet mapping pipelines** using SAM2 that identified **100+ new boulders** and generated high-resolution global surface maps of Comet 67P. Co-authored a peer-reviewed publication in **JAAVSO** on red giant variability.

EDUCATION

UNIVERSITY OF TORONTO

BSc, Astronomy & Astrophysics; Cognitive Science
Expected 2026 | Toronto, Canada

- Majors in **Astrophysics** and **Cognitive Science**. Coursework in **statistics, AI, astrophysics, neuroscience, machine learning**.
- **AST425 ML-for-Cosmology thesis (CosmoPower emulator development)** with Prof. Renée Hložek & Dr. Tanveer Karim.

UNIVERSAL AMERICAN SCHOOL OF DUBAI

International Baccalaureate Diploma
2022 | Dubai, U.A.E

SKILLS

PROGRAMMING & AI

Python, PyTorch, NumPy, SciPy, Jupyter, Matplotlib
Machine Learning: SAM2, segmentation models, computer vision, classical ML
Signal Processing: wavelet analysis, variability modeling
Statistics: Mann–Whitney U, ANOVA, correlation, survey coding

RESEARCH METHODS

Survey and interview design across **10+ countries**; cross-national dataset construction; scientific writing; LaTeX; data visualization.

TOOLS

Git/GitHub, ESA Planetary Data Access, Rosetta/OSIRIS data handling, Overleaf.

LANGUAGES

English, Urdu, French

AWARDS

IAC 2025 Oral Presentation Acceptance
JAAVSO Publication Recognition
University of Toronto Research Scholarship
Dean's List Scholar

RESEARCH & WORK EXPERIENCE

COSMOLOGY EMULATOR DEVELOPMENT University of Toronto | Machine Learning Researcher

Sep 2025 – Present

- Developing neural network emulators (**CosmoPower**) to approximate **CMB power spectra** and accelerate cosmological inference.
- Optimized emulator accuracy by **48% for temperature (TT) spectra** through architecture and batch tuning.
- Designed evaluation pipelines for **40k+ spectra**, enabling scalable validation across cosmological parameter space.

COMET SURFACE ANALYSIS NYU Abu Dhabi | Researcher

Apr 2025 – Present

- Developed **machine-learning imaging pipelines** for ESA Rosetta OSIRIS datasets, generating **high-resolution global boulder maps** of Comet 67P.
- Fine-tuned **SAM2 segmentation models** for planetary computer vision workflows, enabling the automated identification of **100+ previously unrecognized boulders**.
- Established processing benchmarks for AI-assisted planetary surface mapping.

CUBESAT CAPACITY BUILDING University of Toronto Aerospace Team (UTAT) | Lead Researcher

Oct 2024 – Present

- Led the **first international comparative study** of CubeSat national program structures.
- Designed and deployed **cross-national surveys and interviews** across 10+ countries, generating a novel dataset on structural barriers.
- Study accepted for **oral presentation at IAC 2025**, informing global space accessibility.
- Published in the **IAF Space Systems Symposium conference proceedings** (Sydney, 2025), DOI link.

VARIABLE STAR RESEARCH JAAVSO | Co-Author, Peer-Reviewed Publication

Sep 2024 – Jul 2025

- Co-authored a **peer-reviewed JAAVSO publication** categorizing and justifying **54 unusual red giant variability behaviors** using wavelet and time-series analysis.
- Contributed new observational classifications to international stellar catalogs.
- Presented at the 114th AAVSO Annual Meeting (view paper).
- Featured as JAAVSO's **Research Highlight of the Month** (Dec 2025).

TOYOTA DUBAI Customer Experience Receptionist

Mar 2021 – May 2021

- Delivered high-volume client support; featured on **Dubai Eye Radio**.

LEADERSHIP & OUTREACH

- **Physics Faculty Ambassador**, University of Toronto Research Network (UTRN); **Orientation Leader 2025**, Woodsworth College.