Ali Pourmand

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Education

2025 – 2028 **P.hd., Macquarie University** Astrophysics.

2020 – 2023 **M.Sc., University of Alberta** Physics.

2018 – 2020 **Minor's Degree, University of Tehran** Physics.

2015 – 2020 **B.Sc., University of Tehran** Mechanical Engineering.

Research and Work Experience

Astrophysics and Cosmology

2021-2023 **Master's degree thesis, University of Alberta, Edmonton, Alberta, Canada**, writing a code to numerically determine various properties of binary systems in a one-dimensional approximation, to use these quantities to simulate binary systems with a one-dimensional stellar evolution code. This topic involved working with Fortran and Python, implementing new physics into MESA, and utilizing supercomputing clusters such as Compute Canada, under Prof. Ivanova's supervision. Link to thesis: https://era.library.ualberta.ca/items/5fbe25fb-9ed6-4ce1-8625-e8750c2ee550/view/d4e02531-2663-4c9d-b42d-8f0ce6f981c4/Pourmand_Ali_202306_MSc.pdf

Ongoing **Independent Research Project**, Constraining the parameters of $f(Q)$ cosmology, with available data from quasar observations. My contribution involved working with the EMCEE package for Monte-Carlo simulations, and extracting data from astronomical catalogues in VizieR.

Jan-March 2021 **Research project, University of Alberta, Edmonton, Alberta, Canada**, Developing a numerical solver for the Saha equation for a mixture of Hydrogen and Helium, under Professor Ivanova's supervision.

Summer 2017, Summer 2018 **Research experience, School of Astronomy, Institute for Research in Fundamental Sciences (IPM), Tehran, Iran**, astronomical image processing with the IRAF software. The motive was to obtain the star formation histories of several galaxies, under Prof Javadi's supervision.

Engineering

2019 **Bachelor's degree thesis, University of Tehran, Tehran, Iran**, simulating the annual variations in the performance of solar-powered stirling systems in several cities of Iran with MATLAB.

Summer 2019 **Summer internship, Sina Robotic and Medical Innovators, Tehran, Iran**, modelling components of a laparoscopic surgical instrument that will be used for robotic surgery with the SOLIDWORKS software and determining the different medical standards required for these devices to be applicable.

Teaching Experience

Summer-Winter 2023 — **Tutor, Varsity Tutors** Private tutoring for high-school and college students, on various topics (mostly related to physics).

Fall 2022 — **Teaching Assistant, University of Alberta** ASTRO 465/565, stellar astrophysics II lecture support; assisting students with installing and using the stellar evolution code MESA. Website I designed for the course: https://sites.google.com/view/astro-465-565-fall-2022/

Winter 2021 — **Teaching Assistant, University of Alberta** Phys 124; Particles and Waves (lecture support, etc.).

Fall 2021 — **Teaching Assistant, University of Alberta** Astro 120; Astronomy of the Solar System (Grading).

Winter 2020 — **Teaching Assistant, University of Alberta** Phys 126 Lab; Fluids, Fields and Radiation (Lecturing and Grading).

Summer 2018 — **Science teacher, Emam Hossein high school** Middle school level science at a summer school.

Research Publications

Published

1. Ivanova, N., Kundu, S., & Pourmand, A. (2024). Unified rapid mass transfer. *The Astrophysical Journal*. Retrieved from https://iopscience.iop.org/article/10.3847/1538-4357/ad583e
2. Pourmand, A., & Ivanova, N. (2023). Properties of binary systems in a one-dimensional approximation. *The Astrophysical Journal*. Retrieved from https://iopscience.iop.org/article/10.3847/1538-4357/acd4c1/meta

Conference Papers

1. Pourmand, A., & Ivanova, N. (2024). Accurate simulations of binary stars up to mass transfer ignition. In *26th meeting on research in astronomy at iasbs*. Retrieved from https://iasbs.ac.ir/~astro/26/docs/Proceeding%20(astro%2026).pdf

Preprints

1. Aggarwal, N., Pourmand, A., Shojai, F., & Parthasarathy, H. (n.d.). Constraining Generalized Chaplygin Gas in Non-Minimally Coupled $f(Q)$ Cosmology Using Quasars and $H(z)$ Data. Retrieved from https://arxiv.org/abs/2212.00312

Talks and Poster Presentations

Talks

March 2025 — **Sydney Harbour Stars and Planets, UNSW** Accurately Simulating Binary Stars in 1D

May 2024 — **26th Meeting on Research in Astronomy IASBS, Institute for Advanced Studies in Basic Sciences** Accurate Simulations of Binary Stars up to Mass Transfer Ignition

April 2024 — **Department of Physics, University of Tehran** Modelling Phenomena in Modern Astrophysics: Binary Stars

Talks and Poster Presentations (continued)

- **Weekly Seminar, School of Astronomy, Institute for Research in Fundamental Sciences (IPM)** Modelling Phenomena in Modern Astrophysics: Binary Stars

July 2022
- **OAC virtual talk, School of Astronomy, Institute for Research in Fundamental Sciences (IPM)** Current problems in binary evolution: the initial conditions for a common envelope event

Poster Presentations

April 2025
- **2025 Physics Research Poster Presentation Network Event, Australian Institute of Physics - NSW Branch** Pourmand, A., Kamath, D., De Marco, O., Wardle, M., Van Winckel, H., Planets Born around Dying Stars

October 2022
- **GPSA Symposium, University of Alberta** Pourmand, A., Ivanova, N., Simulating Binary Systems at the Onset of the Common Envelope Phase
  `https://github.com/AliPourmand/GPSA-Symposium-Poster-2022-University-of-Alberta/blob/main/poster.pdf`

Awards and Accomplishments

2025
- **International Macquarie Research Excellence Scholarship ("iMQRES")**, Issued by Macquarie University, Australia.

2022
- **2nd Place for Student Talk- GPSA symposium, Issued by GPSA, the University of Alberta**, Title of Talk: The Initial Conditions of The Common Envelope Phase in Binary Stellar Evolution.
- **2nd Place for Student Talk- GPSA symposium, Issued by GPSA, the University of Alberta**, Title of Talk: The Initial Conditions of The Common Envelope Phase in Binary Stellar Evolution.

2020
- **2nd place in the nationwide entrance exam for graduate school in "philosophy of science"** Issued by Sanjesh, Iran.
- **28th place in the nationwide entrance exam for graduate school in Iran in "physics"** Issued by Sanjesh, Iran.
- **Graduate Research Assistant Fellowship (GRAF)** Issued by University of Alberta, Canada.

Skills

Programming

Languages	Fortran, Python, C++, MATLAB, Git, Bash, Slurm
Operating Systems	Linux (Fedora, Ubunta), Windows, Mac
Monte-Carlo	EMCEE
Other.	LaTeX

Astronomy

Stellar Evolution Code	MESA
Astronomical Catalogues	VizieR
Hydrodynamics code	Athena++, Phantom
Photometry	IRAF, DS9
Other	AMUSE

Skills (continued)

Misc.

Engineering Simulation and Design Software	SOLIDWORKS, AutoCAD, COMSOL, EES
(Other) Languages	French (elementary)

Workshops and Events

2022 **McGill Physics Hackathon**, McGill University, Canada. Our Project was on simulating how different animal species in an ecosystem impacts the population evolution of other species; e.g. the effect of including wolves in the Yellowstone National Park. link to project:
`https://devpost.com/software/the-chaotic-food-chain`

AMUSE Summer School, held at the Geneva Observatory, Switzerland.

2021 **MESA Summer School** University of California, Santa Barbara.

2020 **WestGrid Autumn School** subjects were topics such as Bash, HPC, Git, etc.

Volunteer Activities and Outreach

2025 Volunteer at the Macquarie University Observatory

Macquarie Experience Day, introduced my field to high school students, Macquarie University, Sydney, Australia

2023,2022 Volunteer at the Iranian tent at Edmonton Heritage Festival (performing music, preparing food), Edmonton, Canada

2021 Volunteer at the University of Alberta Observatory

2019 Collaborated in organizing several ceremonies at the University of Tehran, e.g. performing several songs for the Persian New Year (Nowruz) ceremony

Exam Scores

2024 **Academic IELTS**, Score: 8.5/9.0.
S: 7.5 L: 8.0 R:9 W: 8.5.

2021 **TOEFL IBT**, Score: 120/120.

2019 **Physics Subject GRE** Score 930/990.

General GRE exam Verbal Reasoning: 159/170, Quantitative Reasoning: 168/170, Analytical Writing: 4.5/6

Miscellaneous

- Music: harmonica, piano, tombak (persian instrument)
- Sports: Kyokushin Karate 1st Dan, Completed a full (42km) Marathon
- Participated in Messier Marathon in Iran, 2016