Aarya Patil

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RESEARCH INTERESTS

My research spans a wide range of data-rich problems on the formation and evolution of the Milky Way galaxy. I develop novel statistical and computational methods to study stellar populations in the galaxy using a combination of spectroscopic, asteroseismic, and astrometric data.

EDUCATION

University of Toronto — Toronto, Canada
PhD (Direct-Entry) in Astronomy & Astrophysics — 2018 - Present
Thesis: Decoding the Age-Metallicity Structure of the Milky Way disk
Supervisors: Profs. Jo Bovy & Gwendolyn Eadie

S. P. Pune University, Pune Institute of Computer Technology — Pune, India
Bachelor of Engineering (B.E.), Computer Engineering — 2014 - 2018
Ranked within top 5 among 250 students in the department; C.G.P.A. 9.45/10

MAJOR AWARDS & HONORS

Data Sciences Institute Doctoral Student Fellowship — 2022 - 2025
Data Sciences Institute, University of Toronto — CAD 79,500
CAD 25,000 (+ 1,500 travel funds) per year for three years

International Graduate Student Doctoral Fellowship — 2021 - 2022
D. A. D. Dept. of Astronomy & Astrophysics, University of Toronto — CAD 3,000

Astrostatistics Interest Group's Student Paper Competition Finalist — Jan 2021
American Statistical Association, Gordon and Betty Moore Foundation — USD 1,100
Selected as one of 5 finalists for Patil et al. (2022)

Delta Kappa Gamma World Fellowships Alternate (Runner-up) — Jan 2021
International World Fellowship Committee, Delta Kappa Gamma

C.A. Chant Fellowship in Astronomy — 2018 - 2022
D. A. D. Dept. of Astronomy & Astrophysics, University of Toronto — CAD 45,000

University of Toronto Fellowship — 2018 - 2022
Faculty of Arts & Science, University of Toronto — CAD 15,470

Program-Level & Graduate Program Fellowship — 2018 - 2022
Faculty of Arts & Science, University of Toronto — CAD 11,986

Massey College Junior Fellowship, University of Toronto — 2018 - 2021
Jackman Scholar Bursary & Ondaatje Bursary Award — CAD 10,950

PUBLICATIONS

Peer-Reviewed Articles

In preparation

Patil, A. A.; Bovy, J.; & Jaimungal, S. "Decoding the Age-Metallicity Structure of the Milky Way disk: An application of Copulas and Elicitable Maps". To be submitted to the Monthly Notices of the Royal Astronomical Society.

Sun, J.[1]; **Patil, A. A.**; Guo, J.; & Zhou, S. "A Case Study of an Open-Source Scientific Software". To be submitted to the ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering (ESEC/FSE) 2023.

Submitted
Patil, A. A.; Eadie, G.; Speagle, J.; & Thomson, D. "Multitaper Spectral Estimation in Asteroseismology". Submitted to The Astronomical Journal.

Published
The Astropy Collaboration, Price-Whelan, A. M.; Lim, P. L.; Earl, N.; Starkman, N.; Bradley, L.; Shupe, D. L.; **Patil, A. A.** et al. (2022). "The Astropy Project: Sustaining and Growing a Community-oriented Open-source Project and the Latest Major Release (v5. 0) of the Core Package". The Astrophysical Journal, Volume 935, Issue 2, article id 167, 20pp. arXiv/2206.14220 [12 citations]

Patil, A. A.; Bovy, J.; Eadie, G.; & Jaimungal, S. (2022). "Functional Data Analysis for Extracting the Intrinsic Dimensionality of Spectra: Application to Chemical Homogeneity in the Open Cluster M67". The Astrophysical Journal, Volume 926, Issue 1, article id. 51, 24pp. [arXiv/2109.10891] [1 citation]

Astropy Collaboration et al. including **Patil, A. A.** (2018). "The Astropy Project: Building an Open-science Project and Status of the v2.0 Core Package". The Astronomical Journal, Volume 156, Issue 3, article id. 123, 19 pp. [arXiv/1801.02634] [3985 citations]

Non-Peer-Reviewed Articles

Cruz, K.; Gnther, H. M.; **Patil, A.**; Swinbank, J.; & Tollerud, E. (2022). "Astropy Proposal for Enhancement 19: Distributing Astropy Project Funding (APE19)". Technical Report, Zenodo. https://doi.org/10.5281/zenodo.6312048

Patil, A.; Bovy, J.; & Eadie G. (2020). "Likelihood-free Inference of Chemical Homogeneity in Open Clusters". 2020 Joint Statistical Meetings (JSM) Proceedings, American Statistical Association (ASA), pp 1838-1844.

MENTORSHIP

Graduate Students

Jiayi Sun (Elec. & Comp Eng., UToronto, Canada) Winter 2022 - Present
Co-mentored with Profs. S. Zhou (UToronto) and J. Guo (McGill University)
Mentoring a PhD research project with NumFOCUS on improving collaboration efficiency of interdisciplinary scientific software development teams

Suyog Garg (Mech. Eng. IIITD&M, India → Physics, UTokyo, Japan) Summer 2021
Co-mentored with Dr. H. M. Guenther (MIT)
Mentored a Google Summer of Code (GSoC) project to incorporate the MRT and CDS ASCII table writers in Astropy, the largest open-source, community-developed Python package in astronomy. This writer automates the process of publishing data in the standard AAS and VizieR/CDS catalogues.

PRESENTATIONS

INVITED TALKS

Invited Seminar in the Good Vibrations Seminar Series 26^{th} October 2022

Invited to lead a session on Project Governance & Management May 2022
Astronomical Software Development Workshop NY, USA

[1] mentee

Invited Talk (virtual) in the Around the World Speaker Series Nov 2021
Women of Aeronautics and Astronautics (WoAA) India

Invited Student Speaker (virtual) in the Bayesian Breakout Session June 2021
Statistical Challenges in Modern Astronomy (SCMA) VII Virtual Conference

Invited Talk (virtual) Dec 2020
Joint Conference for School & University students on Natural & Mathematical Sciences Kharkiv, Ukraine

Invited Talk (virtual) Nov 2020
International CHASC AstroStatistics Centre, Harvard University Boston, MA

SELECT CONFERENCES & SEMINARS

Astrostatistics Interest Group's Student Paper Competition Talk Aug 2022
Joint Statistical Meetings (JSM) Conference Washington D.C.
Received Reinhardt and Moore Foundation Travel Awards

Contributed Talk (virtual) June, 2022
Multitaper Spectral Analysis Workshop Online

Statistics and Machine Learning Journal Club Talks Oct 2020, Nov 2021
D. A. D. Dept. of Astronomy & Astrophysics, University of Toronto

Contributed Talk (virtual) Oct 2021
HRMOS Science Workshop Italy, Australia & Online

Contributed Talk (virtual) Aug 2020; Aug 2021
Joint Statistical Meetings (JSM) Virtual Conference
Received Reinhardt Travel Award

Talk (virtual) June 2020; Aug 2021
Sloan Digital Sky Survey (SDSS) Virtual Meeting

Talk (virtual) June 2021
GALactic Archaeology with HERMES (GALAH) Science Meeting Australia & Online

Stellar Stats Workshop Talk (virtual) June 2021
Astronomy & Astrophysics and Statistical Sciences Depts., UToronto

Poster Presentation (virtual) June 2021
SCMA VII Virtual Conference

Poster Presentation June 2019
Canadian Astronomical Society (CASCA) Conference Montreal, QB
Received Reinhardt Travel Award

Lightning Talk April 2018, Aug 2019
Python in Astronomy Conference Baltimore, MD; New York, NY
USD 2,500 from Simons Foundation; Received USD 1,200 from STScI

Poster presentation Oct 2018
Global Radio Scintillometry Astrophysics Conference Shanghai, China
Received Reinhardt Travel Award

Instrumentation and Machine Learning Club Talk June 2017

Inter-University Centre for Astronomy and Astrophysics — Pune, India

Antariksh Astronomy Club Talk — Nov 2016
Vishwakarma Institute of Technology — Pune, India

TEACHING EXPERIENCE

INSTRUCTOR

Pan-African School for Emerging Astronomers (PASEA) 2022 — Oct 2022
Teaching the postgraduate stream a Python/Astropy workshop — Livingstone, Zambia

PASEA Alumni Research Program (virtual) 2022 — Summer 2022
Developed and taught a Python workshop on Astronomical Data Analysis to alumni

TEACHING ASSISTANTSHIP

Head Teaching Assistant (Course Contact) — Winter 2022
Head Teaching Assistant (Course Project) — Winter 2021
AST 201: The Sun and its Neighbours
Responsibilities: Leading 30+ teaching assistants for providing course contact support – course project support – holding support sessions, answering discussion board questions/emails, coordinating marking

Teaching Assistant — Fall 2020, 2021
AST 221: Stars and Planets
Responsibilities: Designing and running weekly tutorials to help with lecture material and assignments, holding office hours, answering discussion board questions, marking exams

Teaching Assistant — Winter 2019, Winter 2020, Summer 2020
AST 201: The Sun and its Neighbours
Responsibilities: Running weekly tutorials, creating test questions, delivering planetarium shows, answering emails, assisting observing nights, exam invigilation and marking

Teaching Assistant — Fall 2018, 2019
AST 101: Stars and Galaxies — Responsibilities: Same as **AST 201**

TUTORING EXPERIENCE

Astrophysics Tutor with Onsen Education — July 2021

Physics, Mathematics, Computer Science Tutor (Volunteer) — Winter 2020
Massey Tutoring and Mentorship Program, Massey College, UToronto

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TRAINING & CERTIFICATION

Teaching Fundamentals Certificate — Sep 2021 - Sep 2022
Teaching Assistants' Training Program, University of Toronto

Advanced Training in Academic Writing and Speaking — Sep 2020
Graduate Centre for Academic Communication, University of Toronto

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FUNDING PROPOSALS

Astropy Cycle III Funding Proposal — USD 11,550
"Pan-African School for Emerging Astronomers 2022: Zambia", PI

Dunlap Seed Funding Proposal — CAD 6,868
"Intertwining Dunlap/UofT and Sustainable Open Source Software via Astropy", Co-I
Funding to create a Coding Support RAship and incorporate an open-source software focus in the Dunlap Postdoctoral Fellowship.

Dunlap Seed Funding Proposal CAD 29,100
"Pan-African School for Emerging Astronomers 2022: Zambia", Co-I

EXTRA-CURRICULAR LEADERSHIP

OUTSIDE THE UNIVERSITY

Gaia Hike SOC Member June 2022
Co-developed the talk/tutorial schedule and led the unconference session programming

Finance Committee Member Dec 2021 - Present
Voting Member July 2021 - Present
#30 Core Contributor March 2017 - Present
The Astropy Project Open-source software
Helped raise and manage ∼1.6 million USD from the Moore Foundation, NASA, etc.
One of the ∼40 trusted individuals elected to operate Astropy on behalf of the community
Ranked 30^{th} in code contributions to the core, which is used by ∼30,000 public softwares

International WoAA Member Nov 2021 - Present
Volunteering for the WoAA International (+India) Board to start a Toronto chapter

Programming Head June 2016 - June 2018
Pune Institute of Computer Technology (PICT) ROBOCON Team Pune, India
Led the PICT team in the ABU Asia-Pacific Robotics Competition, ROBOCON

Team Leader Aug 2015 - June 2018
`XOdia`: A web application for Artificial Intelligence (AI) based Gaming Competitions
Led a team of 50+ students to develop `XOdia`; created an original two-player computer game

INSIDE THE UNIVERSITY

D. A. D. Dept. of Astronomy & Astrophysics, University of Toronto.....

Statistics & Machine Learning Journal Club Committee Winter 2022
Running bi-weekly meetings to discuss statistics & machine learning in astronomy

Anti-Racism Meetings Organizing Committee Sep 2021 - Present
Running weekly meetings to learn and to take action against racism in the workplace

Undergraduate Mentor Sep 2021 - Present
Mentoring undergraduate students in the department

Graduate Astronomy Students Association, University of Toronto.....

Mental Health Committee Member Sep 2020 - Sep 2021
Developing a survey to assess the general state of mental health in the department within the context of Covid-19, which will inform the measures we can take to support the community

Health and Safety Committee Student Representative Sep 2020 - Sep 2021
Improving Health and Safety protocols in the department, especially for COVID-19

Mentorship Committee (International) Lead Sep 2020 - Sep 2021
Organising talk shows and events to cater to international student needs

Graduate Student Mentor Sep 2020 - Sep 2021
Mentored an incoming graduate student in the department

Course Committee Sep 2018 - Sep 2019

Provided course organisation and scheduling recommendations based on student feedback

Dunlap Institute for Astronomy & Astrophysics, University of Toronto.....

Learn Astropy Project Local Representative Nov 2021 - Present
Scientific Software Engineering Learning Resources with the Astropy Learn Project
Improving the programming skills of the Institute/Department and developing educational resources for Astropy

Massey College, University of Toronto.....

Governing Board Risk Committee Member July 2020 - Present
Massey College, University of Toronto
First student elected to serve on the committee; helped develop the COVID-19 risk plan

Anti-Racism Committee Co-Chair Sep 2020 - May 2021
Massey College, University of Toronto
Help create a safe space for racialised community members

Lionel Massey Fund (LMF) Co-chair & Treasurer June 2019 - May 2020
Massey College, University of Toronto
Organized several events for Junior Fellows with an emphasis on multicultural festivities

MasseyScope Committee Co-founder Jan 2019 - Present
Massey College, University of Toronto
Co-founded MasseyScope, a committee that organises astronomy outreach for the Massey community and the general public with a focus on underprivileged communities

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OTHER OUTREACH

National Society of Black Physicists (NSBP) Booth Volunteer Nov 2020
Ran a virtual exhibitor booth for the University of Toronto at the NSBP Conference

Astronomy on Tap Toronto Volunteer Sep 2018 - March 2020, 4 times annually
Helping with set up logistics, answering astronomy questions from the general public

AstroTours Toronto Outreach Volunteer September 2018 - March 2020, *monthly*
Operating the Oculus Rift/WorldWide Telescope, answering general public questions

Planet Party Toronto Volunteer Sep 2019
Organized observations of planets and their moons for the planet party

Science Rendezvous Toronto Volunteer May 2019
Organized physics demonstrations for the general public and answered questions

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MEDIA

Massey Dialogues 5^{th} May 2021
Topic: The Stars are Aligned, the Future of Astrophysics

RESEARCH & PROFESSIONAL EXPERIENCE

Canadian Institute for Theoretical Astrophysics Sep 2018 - April 2019
Graduate Researcher Advisors: M. van Kerkwijk, U. Pen, C. Ng
Developed an automated pipeline to detect echoes in the northern hemisphere pulsars observed by the Canadian Hydrogen Intensity Mapping Experiment (CHIME) telescope, and found a new potential echo in the B1508+55 pulsar that led to follow-up studies

Inter-University Centre for Astronomy and Astrophysics Aug 2017 - 2018
Undergraduate Researcher Advisor: R. Gupta

Implemented a ladder networks based semi-supervised deep learning model for spectral classification of the LAMOST survey; slightly outperformed traditionally used neural networks

GSoC 2017 participant with OpenAstronomy Summer 2017
Student Developer Mentors: T. Aldcroft, M. van Kerkwijk, H. M. Guenther
Selected for the prestigious GSoC program (∼18% proposals selected in 2017)[2] as a developer for Astropy and successfully completed the program; developed the first open source implementation that covers nearly the full FITS time standard in a generic and instrument independent way, an issue that was open in Astropy since Sep 2014.

Inter-University Centre for Astronomy and Astrophysics Jan - June 2017
Undergraduate Researcher Advisor: S. Abraham
Implemented a Support Vector Machines and Random Forests model and improved the accuracy of periodic variable classification in the Catalina Surveys Periodic Variable Catalog

Inter-University Centre for Astronomy and Astrophysics April - Oct 2016
Undergraduate Researcher Advisor: K. Vaghmare
Acquired and reduced UBV images of the open cluster NGC 2420 & globular cluster M 80; applied clustering to automate the standard technique of distance modulus calculation

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OTHER AWARDS

Start-Up Funds Fellowship Awarded 2019
D. A. D. Dept. of Astronomy & Astrophysics, University of Toronto CAD 3,000

Quarter Century Fund for MasseyScope Committee Awarded 2018, 2019
Massey College, University of Toronto CAD 1,187

ABU ROBOCON 2017 - All India Rank 10 out of 125 teams March 2017
Programming head, Pune Institute of Computer Technology (PICT) Robotics Team

Junior College Certificate Scholarship 2014
Maharashtra State Council of Education (MSCE), India INR 20,000

INSPIRE Scholarship for Higher Education (declined) Awarded 2014
Department of Science and Technology, Government of India

TECHNICAL SKILLS

Open Source Software Development
Contributor: Astropy, Numpy, Sewpy
Developer: tapify

Programming Languages
Python, C/ C++, R, Shell Script, JavaScript

Competitive Coding
CodeChef

Frameworks, Tools, Hardware
Git, Emacs, TensorFlow, MATLAB, CUDA

LANGUAGES

English Full Professional Proficiency **German** Limited Working Proficiency
Hindi Native or Bilingual Proficiency **Marathi** Native or Bilingual Proficiency

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[2] https://opensource.googleblog.com/search/label/statistics+gsoc