

Juan Pablo Alfonso

ASTROPHYSICS GRADUATE STUDENT · ASTROSTATISTICS · GALAXY FORMATION & EVOLUTION

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Summary

My research lies in the area of **galaxy evolution and formation** within astrophysics. My research in particular is very programming/computationally heavy. I like describing my area of research as an **intersection between astronomy, statistics, and computer science**, specifically **machine learning and deep learning**. My research has a heavy emphasis on machine learning and **artificial neural networks** to help answer research questions associated with galaxy evolution and formation. Currently most of my research is focused on trying to understand how galaxy structures are formed, and how they change with time.

Education

Tohoku University (東北大学)

Sendai, Japan

PHD IN ASTRONOMY

Oct. 2022 - Oct. 2027

- Supervisors: Prof. Masayuki Akiyama & Dr. Kartheik Iyer (Columbia University/Flatiron Institute)

University of Toronto

Toronto, Canada

HONS. BSC. IN ASTRONOMY AND PHYSICS

Sept. 2017 - Jun. 2021

- Math minor and Philosophy minor
- Thesis Supervisor: Dr. Mubdi Rahman

Research Experience

Tohoku University (東北大学)

Sendai, Japan

GRADUATE STUDENT RESEARCHER

Oct 2022- Present

- Working on applying **machine learning and deep learning techniques** to problems in various areas of astronomy
- Primarily interested in extra-galactic astronomy
- Supervisor: Prof. Masayuki Akiyama & Dr. Kartheik Iyer (Columbia University/Flatiron Institute)

Columbia University

New York, USA

VISITING RESEARCHER

Feb 2025 - April 2025

- Working with Dr. Kartheik Iyer to understand the morphology of galaxies in the Illustris-TNG50 simulation suite

Center for Computational Astrophysics (The Flatiron Institute)

New York, USA

VISITING RESEARCHER

Feb 2025 - April 2025

- Working with Dr. Francisco Villaescusa-Navarro to understand how dark matter models and cosmological models in the DREAMS project effect galaxy morphology

University of Toronto

Toronto, Canada

VISITING RESEARCHER

Nov 2024 - Feb 2025

- Working with Dr. Mike Walmsley and Prof. Josh Speagle to study the morphology of galaxies targeted by the Euclid space telescope

University of Toronto

Toronto, Canada

SURP RESEARCHER/ RESEARCH SCHOLAR

May 2021 - Sept 2022

- Working on **training a convolutional neural network (CNN) to classify galaxies in the MaNGA survey**, while studying what features of the galaxies the neural network is focusing on to make the classification with the use of **CAM methods**.
- Network being created and trained using the **pytorch** Python package and working in a **Linux based environment** and using **Google Colab**
- Final goal is to have the CNN be able to predict the star forming history of the galaxies from their visual image and photometric information. Aim to **not only having a working CNN but to be able to pick it apart to understand how it is making decisions and extract relevant physics**
- Project Supervisor: Dr. Kathreik Iyer (Dunlap Institute)

University of Toronto

Toronto, Canada

UNDERGRADUATE RESEARCHER

Aug. 2020 - Apr. 2021

- Investigated morphological changes in galaxies as they evolve in time, by studying their internal kinematics using the MaNGA survey.
- Analysis being done using Python based code with **heavy use of machine learning algorithms such as DB scan and PCA** from the **sci-kit learn** library. Full write up of project can be found [here](#)
- Unique use of PCA** which focused more on using the actual PC vectors rather than using them as the basis in a PC profile plot
- Project Supervisor: Dr. Mubdi Rahman (Dunlap Institute)

First-Author Publications

2024 **Katachi (形): Decoding the Imprints of Past Star Formation on Present Day Morphology in Galaxies with Interpretable CNNs**, Alfonso J., Iyer K., Akiyama M., et al., [ApJ 967 152](#)
Full Publication List, Reviewer for *Astronomy & Astrophysics (A&A)*

Selected Presentations and Talks

Cosmology and Galaxy Astrophysics with Simulations and Machine Learning 2024

POSTER PRESENTATION

New York, USA

Dec. 9-12, 2024

10th Galaxy Evolution Workshop

CONTRIBUTED TALK

Taipei, Taiwan

Aug. 6-9, 2024

SUPER-IRNET Workshop 2024

CONTRIBUTED TALK

Beppu, Japan

Jul. 23-26, 2024

IPMU Astrophysics Lunch Talk

INVITED TALK

Kashiwa, Japan

Jun. 18, 2024

ELT Science in Light of JWST

POSTER PRESENTATION

Sendai, Japan

Jun. 3 - Jun. 7, 2024

Recipes to Regulate Star Formation at All Scales

POSTER PRESENTATION

Baltimore, USA

Apr 15-19, 2024

East Asian Young Astronomers Meeting 2024

POSTER PRESENTATION

Chiang Mai, Thailand

Jan 30 - Feb 2, 2024

AI-Driven Discovery in Physics and Astrophysics

FLASH TALK PRESENTER

Kashiwa, Japan

Jan 22-26, 2024

Machine Learning in Astronomical Surveys (IAP/CCA 2023)

POSTER PRESENTATION (REMOTE)

Paris, France & New York, USA

Nov 27 - Dec 1, 2023

Resolving Universe

POSTER PRESENTATION

Tokyo, Japan

Nov 5-10, 2023

Statistical Challenges in Modern Astronomy VIII

POSTER PRESENTATION

State College, USA

June 12-16, 2023

ART (Astrostats) Meeting

SEMINAR TALK

Toronto, Canada

Mar. 30, 2023

9th Galaxy Evolution Workshop

CONTRIBUTED TALK

Kyoto, Japan

Feb. 21, 2023

HSC-AGN Meeting 2022

CONTRIBUTED TALK

Kagoshima, Japan

Dec. 2, 2022

SDSS Collaboration Meeting 2021

PRESENTER IN DATA 1 SERIES AND LIGHTING TALK 1 SERIES

Baltimore, USA

Aug. 11, 2021

Awards

SUPER-IRNET Travel Funding

Baltimore, USA

POSTER PRESENTER

Apr 15 - Apr 19, 2024

- Secured full travel and accommodation funding to present a poster at a star-formation conference at STScl. (¥550,000)

Graduate Program on Physics and the Universe (GPPU) Fellowship

Sendai, Japan

GPPU STUDENT

April 2024 - Oct 2027

- Fellowship for the graduate program at Tohoku University for Physics and Astronomy PhD students. The fellowship provides full financial funding to students, and includes travel funding. (≈ ¥11,500,000)

SUPER-IRNET Travel Funding

Tokyo, Japan

POSTER PRESENTER

Nov 5 - Nov 10, 2023

- Secured full travel and accommodation funding to present a poster at an ALMA and JWST conference at Waseda University. (¥76,940)

SUPER-IRNET Travel Funding

State College, USA

POSTER PRESENTER

June 4- June 17, 2023

- Secured full travel and accommodation funding to attend an astrostats summer school and to do a poster presentation at an astrostats conference at Penn State. (¥734,525)

2022 Embassy Recommended Research MEXT Scholar

Sendai, Japan

GRADUATE STUDENT

Oct 2022 - Oct 2024

- The Japan Ministry of Education, Culture, Sports, Science and Technology (in Japanese: Monbukagakusho, English acronym: MEXT) offers scholarships to Canadian students wishing to pursue their studies at a Japanese university. For graduate studies (non-degree, masters or doctorate) in any university subjects. Scholarship provides: full tuition coverage, monthly allowance, round-trip between Canada and Japan, and Japanese language training. Information can be found [here](#) (≈ ¥10,000,000)
- Offered extension to PhD course, but declined due to a fellowship being awarded

2021 SURP Top Poster Award

Toronto, Canada

POSTER PRESENTER

Aug 13, 2021

- Won top poster award for poster conference that was held to summarize all research projects carried out in the SURP program at the University of Toronto in the summer of 2021 (\$50)