

# 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 area 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**. A lot of the work I have done and hope to continue doing heavily involves programming and using Python based algorithms. These algorithms have a heavy emphasis on machine learning and **artificial neural networks** to help answer research questions associated with galaxy evolution and formation.

## Education

### Tohoku University (東北大学)

Sendai, Japan

PHD IN ASTRONOMY

Oct. 2022 - Oct. 2027

- Supervisor: Prof. Masayuki Akiyama (秋山正幸教授)
- IGPAS Program

### University of Toronto

Toronto, Canada

HONS. BSc. IN ASTRONOMY AND PHYSICS

Sept. 2017 - Jun. 2021

- Math minor and Philosophy minor

## 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 (秋山正幸教授)

### 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 spectral 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)

## 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., Accepted to ApJ, [arxiv 2404.05146](#)

## Presentations and Talks

### 10th Galaxy Evolution Workshop

Taipei, Taiwan

CONTRIBUTED TALK

Aug. 6-9, 2024

## The Physical Processes Shaping the Stellar and Gaseous Histories of Galaxies (Declined)

POSTER PRESENTATION

*Pisa, Italy*  
May 27 - May 31, 2024

## Recipes to Regulate Star Formation at All Scales

POSTER PRESENTATION

*Baltimore, USA*  
Apr 15 - Apr 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 - Jan 26, 2024

## Machine Learning in Astronomical Surveys (IAP/CCA 2023)

POSTER PRESENTATION

*Paris, France & New York, USA*  
Nov 27 - Dec 1, 2023

## Resolving Universe

POSTER PRESENTATION

*Tokyo, Japan*  
Nov 5-10, 2023

## GPPU School

POSTER PRESENTATION

*Sendai, Japan*  
Sept 28, 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

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### SUPER-IRNET Travel Funding

POSTER PRESENTER

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

*Baltimore, USA*  
Apr 15 - Apr 19, 2024

### Graduate Program on Physics and the Universe (GPPU) Fellowship

GPPU STUDENT

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

*Sendai, Japan*  
April 2024 - Oct 2027

### GPPU Applicant Travel Funding

POSTER PRESENTER

- Secured full travel and accommodation funding to present a poster at East Asia Young Astronomers Meeting 2024 hosted by NARIT (¥237,540)

*Chiang Mai, Thailand*  
Jan 29 - Feb 3, 2024

### AI-Driven Discovery in Physics and Astrophysics Travel Funding

WORKSHOP ATTENDEE & PRESENTER

- Secured full travel and accommodation funding to attend and present at an AI/ML x Physics/Astrophysics workshop at Kavli IPMU (¥50,000)

*Kashiwa, Japan*  
Jan 22 - Jan 26, 2024

### SUPER-IRNET Travel Funding

POSTER PRESENTER

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

*Tokyo, Japan*  
Nov 5 - Nov 10, 2023

## **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)

## **9th Galaxy Evolution Workshop Travel Funding**

*Kyoto, Japan*

CONTRIBUTED TALK SPEAKER

*Feb 19-25, 2023*

- Secured full travel and accommodation funding from the conference (¥66,004)

## **HSC-AGN f2f Meeting Travel Funding**

*Kagoshima, Japan*

CONTRIBUTED TALK SPEAKER

*Nov 29-Dec 3, 2022*

- Secured full travel and accommodation funding from the conference (¥98,623)

## **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** ( $\approx$  ¥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)