

Maja Jabłońska

PhD Candidate in Astrophysics · Australian National University

maja.jablonska@anu.edu.au github.com/maja-jablonska mso.anu.edu.au/~mjablons/

About

I work at the intersection of stellar astrophysics, radiative transfer, and machine learning. My research focuses on modelling inhomogeneous stellar surfaces, building high-performance spectral synthesis tools, and developing next-generation machine-learning-based emulators for stellar spectroscopy.

Education

Doctor of Philosophy in Astronomy 2023–2027 (expected)

Research School of Astronomy and Astrophysics, Australian National University

- Focus: Machine learning methods for astronomy, stellar spectroscopy, large language models for hypothesis generation, and AI for scientific discovery
- Advisors: Prof. Luca Casagrande, Prof. Melissa Ness, Dr. Ioana Ciucă, Dr. Tomasz Różański, Dr. Sven Buder, Prof. Amanda Barnard

Master of Science in Astronomy 2020–2022

University of Warsaw

- Thesis: Astrometric microlensing of black holes in the Milky Way using Gaia DR3 data
- Coursework included stellar astrophysics, radiative processes, galactic dynamics, extragalactic astronomy, and cosmology
- GPA: 4.84/5.00

Bachelor of Science in Computer Science 2017–2020

Warsaw University of Technology

- Thesis: Astronomical observations analysis — AGN spectra classification using machine learning and the Apache Spark platform
- Coursework included linear algebra, calculus, probability, algorithms and data structures, advanced programming in C++, networking, machine learning, and web development
- GPA: 4.54/5.00

Research Experience

PhD Candidate & Researcher 2023–Present

Research School of Astronomy & Astrophysics, Australian National University

- Development of SPICE – software for synthetic stellar spectra with surface inhomogeneities
- Galactic Bulge chemo-dynamical modeling using SDSS DR19 and Gaia DR3
- Observed multiple nights with VELOCE spectrograph
- Tutor for "Stars and Exoplanets II" Course
- Tutor for "Astronomy and Space" Course
- Refereed manuscripts for *Astronomy & Astrophysics* and the *Journal of Open Source Software*

Deputy Lead 2024–Present
UniverseTBD

- Research on AI applications in astronomy and physical science, focusing on foundational models and hypothesis generation
- Led team coordination by chairing research calls, supporting grant applications, and contributing to the organization’s web presence and visual identity

Summer Research Student 2022
European Southern Observatory

- Applied clustering and photometric analysis to Gaia DR3 data to study open clusters, identify blue straggler candidates, and characterize binary systems

Student Researcher and Developer 2021 – 2023
University of Warsaw

- Lead developer of the Black Hole TOM system for astronomical data processing
- Conducted astrometric microlensing analysis using Gaia data, including preparation for Gaia DR4
- Performed X-ray binary evolution simulations using COMPAS software
- Member of the Gaia Data Processing Consortium (Variability Group)
- Teaching assistant for the “Numerical Methods in Astronomy” course: leading laboratory sessions, preparing and grading assignments, preparing and marking exams, and holding office hours

Skills

Programming: Python, JAX, PyTorch, C++, Julia

Astrophysics: Spectroscopy, Galactic Dynamics, Microlensing, Gaia DR3, PHOEBE, AGAMA

Machine Learning: Large Language Models, Transformers, Convolutional Neural Networks

Extra-Curricular Activities

Conference Organizer 2020–present
ML in PL Association

- Project Leader (2021) - managed all organizational teams for the 2021 (online) edition of the conference, hosting 700+ participants
- Speakers Team Officer (2026) — inviting speakers, organizing the scientific program, and assisting with speaker travel logistics
- Marketing Officer (2022, 2023, 2024, 2025) - social media and communications
- Call of Contributions Officer (2020) - poster management and coordination

Mentoring 2024–2025
ACT Science Mentoring Program

- Helped two high school students with their astronomy and computer science projects
- Oversaw their progress and providing feedback

Harley Wood School for Astronomy Organizer 2025–present
Research School of Astronomy & Astrophysics, Australian National University

- Overseeing the Local Organizing Committee
- Arranging the program and inviting speakers
- Arranging logistics, including speaker and participant accommodation, transport, catering, and networking activities

Mt. Stromlo Colloquium Organizer 2024
Research School of Astronomy & Astrophysics, Australian National University

- Hosted invited speakers and supported the organization, technical setup, and chairing of colloquium sessions

Volunteering

2022–2024

Research School of Astronomy & Astrophysics, Australian National University / University of Warsaw

- Volunteered at the Siding Springs Observatory Open Day
- Volunteered at the European Astronomical Society Annual Meeting 2022
- Volunteered at the ML in PL Conference 2019

Publications

During my Master's and PhD studies, I have published or submitted two first-author papers and over twenty co-authored papers, resulting in **304** citations and an h-index of **12**.

First-author publications

- **Jabłońska, M.**, Różański, T., Casagrande, L., Shah, H., Kołaczek-Szymański, P. A., Rychlicki, M., Ting, Y.-S. (2025). *SPICE — modelling synthetic spectra of stars with non-homogeneous surfaces*.
- **Jabłońska, M.**, Wyrzykowski, Ł., Rybicki, K. A., Kruszyńska, K., Kaczmarek, Z., Penoyre, Z. (2022). *A possible nearby microlensing stellar remnant hiding in Gaia DR3 astrometry*.

Co-authored publications (selected)

- Howil, K., Kruszyńska, K., Zieliński, P. et al. (incl. **Maja Jabłońska**) (2025). *Uncovering the invisible: A study of Gaia18ajz, a candidate black hole revealed by microlensing*.
- Jankovič, T., Gomboc, A., Kostić, U. et al. (incl. **Maja Jabłońska**) (2025). *Astrometry-only detection of microlensing events with Gaia*.
- Różański, T., Ting, Y.-S., **Jabłońska, M.** (2025). *TransformerPayne: Enhancing spectral emulation accuracy and data efficiency by capturing long-range correlations*.
- Zaman, S., Smith, M. J., Khetarpal, P. et al. (incl. **Maja Jabłońska**) (2025). *AstroLLaVA: Towards the unification of astronomical data and natural language*.
- Alkan, A. K., Sourav, S., **Jabłońska, M.** et al. (2025). *A survey on hypothesis generation for scientific discovery in the era of large language models*.
- Kruszyńska, K., Rybicki, K. A., Howil, K. et al. (incl. **Maja Jabłońska**) (2024). *Dark lens candidates from Gaia Data Release 3*.
- Bachelet, E., Rota, P., Bozza, V. et al. (incl. **Maja Jabłońska**) (2024). *A close binary lens revealed by the microlensing event Gaia20bof*.
- Perkowski E., Pan R., Nguyen TD. et al. (incl. **Maja Jabłońska**) (2024). *Astrollama-chat: Scaling astrollama with conversational and diverse datasets*.
- Iyer K., Yunus M., O'Neill C. et al. (incl. **Maja Jabłońska**) (2024). *pathfinder: A Semantic Framework for Literature Review and Knowledge Discovery in Astronomy*.
- Audenaert, J., Bowles, M., Boyd, B. M. et al. (incl. **Maja Jabłońska**) (2024). *The multimodal universe: enabling large-scale machine learning with 100 TB of astronomical scientific data*.
- Maskoliūnas, M., Wyrzykowski, Ł., Howil, K. et al. (incl. **Maja Jabłońska**) (2023). *Lens mass estimate in the Galactic disk extreme parallax microlensing event Gaia19dke*.
- Walmsley, M., Allen, C., Aussel, B. et al. (incl. **Maja Jabłońska**) (2023). *Zoobot: Adaptable deep learning models for galaxy morphology*.

Talks & Posters

Talks

SPICE: Spectra Synthesis for Inhomogeneous Stellar Surfaces — *Astronomical Society of Australia Annual Meeting, University of Adelaide, Adelaide, Australia (2025)*

SPICE: Spectra Synthesis for Inhomogeneous Stellar Surfaces — *Center for Decoding the Universe Inaugural Conference, Stanford University, Stanford, United States (2025)*

SPICE: Spectra Synthesis for Inhomogeneous Stellar Surfaces — *Las Cumbres Observatory Seminar Talk, Santa Barbara, United States (2025)*

SPICE: Spectra Synthesis for Inhomogeneous Stellar Surfaces — *AI Forum, European Southern Observatory, remote (2025)*

SPICE: Spectra Synthesis for Inhomogeneous Stellar Surfaces — *Cosmic Horizons Conference, University of Texas at Austin, Austin, United States (2025)*

UniverseTBD: Democratising Science for Everyone — *NLP in Space Science Workshop, European Space Agency, Madrid, Spain (2024)*

Peering into the Abyss: How We Detect Black Holes — *Siding Springs Observatory Open Day, Siding Springs Observatory, Australia (2024)*

Unlocking Scientific Discoveries with Large Language Models in Astronomy — *ML in PL Conference, Warsaw, Poland (2023)*

Astrometric microlensing in Gaia data — *European Astronomical Society Annual Meeting, Cracow, Poland (2023)*

Nearby Dark Lens Hiding in Gaia DR3 — *25th Microlensing Conference, Paris, France (2023)*

Posters

The link between stellar ages and orbits in the Galactic Bulge — *Cosmology and Galaxy Astrophysics with Simulations and Machine Learning, Flatiron Institute, New York (2024)*

Differentiable Stellar Spectra Integration — *European Astronomical Society Annual Meeting, Cracow, Poland (2023)*

Awards

ZONTA Scholarship — *Australian National University (2025)*

Cosmic Horizons Travel Grant — *University of Texas at Austin (2025)*

NLP for Space Science Grant — *European Space Agency (2024)*

AstroPile Travel Grant — *Flatiron Institute (2024)*

Supporting grant for Women in Data Science — *Why R? Foundation (2021)*

Industry Experience

Software Engineer

2020

Iterators

- Natural Language Processing for speech transcriptions and analysis using `spaCy`
- Transportation cost prediction using machine learning models developed with `Weka` and `PyTorch`, and deployment via a Scala-based model-serving API

Software Engineer

2019

TouK

- System development and unit testing in `Kotlin`
- Proof-of-concept backend for a customisable employee dashboard using `GraphQL` and `Kotlin`

Software Engineer

2018–2019

Vavatech

- Developed and maintained features across multiple systems, including backend components in Java and frontend components in JavaScript
- Designed and executed unit and integration tests using Selenium and Java testing frameworks

Languages

Polish — Native

English — C1

German — B2