# Nathaniel Starkman

Postdoctoral Associate
Brinson Prize Fellow
@ MIT Kavli

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## Education

| | | |
|---|---|---|
| 2018 – 2024 | **PhD in Astronomy & Astrophysics**, University of Toronto | Toronto, ON, Canada |
| 2014 – 2018 | **B.S. in Mathematical Physics and Astronomy**, Case Western Reserve University | Cleveland, OH, USA |

## Professional Appointments

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|---|---|---|
| 2024 – 2027 | **Postdoctoral Associate**, MIT Kavli Institute for Astrophysics and Space Research | Cambridge, MA, USA |
| 2021 – | **Coordinator (2025 – 2028), Strategic Planner (2025 – 2026) & Core Developer**, Astropy | Remote |

## Grants & Fellowships

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|---|---|---|
| Feb 2024 | **Brinson Prize Fellowship**, Prize Fellow, Brinson Foundation | USD 360,000 |
| Jul 2022 | **Astropy Cycle III Funding Grant** | USD 12,000 |
| Jul 2022 | **Astropy Cycle III Funding Grants** | USD 8,000 |
| 2020 – 2023 | **NSERC - CGS D** | CAD 105,000 |
| 2019 – 2020 | **NSERC - CGS M** | CAD 17,500 |
| 2018 – 2024 | **University of Toronto Graduate Fellowship**, University of Toronto | CAD 23,000–32,000 p.a. |

## Awards

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| Jan 2025 | **AAS Lancelot M. Berkeley–New York Community Trust Prize**, American Astronomical Society, *to the Astropy Collaboration* |
| 2014 – 2018 | **Case Western Reserve University Merit Scholarship** |

## Publications

Students I supervised or advised: undergraduate†, graduate‡.

10. **N. Starkman**, J. Nibauer, S. Pearson, S. Wu‡, L. Necib. *When Streams Curve Away: a Test of Dark Matter from Extragalactic Stellar Stream Populations.* SUBMITTED arXiv:2609.40057
9. Euclid Collaboration, **N. Starkman**, J. Nibauer, S. Pearson, S. Wu‡, M. Walmsley, L. Necib, et al. *Euclid Quick Data Release (Q1): The geometry of dark matter halos from extragalactic streams.* Astronomy & Astrophysics SUBMITTED ADS arXiv:2606.21774
8. C. Myers†, **N. Starkman**, L. Necib. *Reconstructing Galactic Gravitational Potentials from Stellar Kinematics with Physics-Informed Neural Networks.* Monthly Notices of the Royal Astronomical Society SUBMITTED ADS arXiv:2606.18386
7. L. Necib, D. Folsom, E. Y. Davies, **N. Starkman**, A. Thoyas. *Galactic Amnesia: The Information Washout of the Milky Way Merger History.* SUBMITTED ADS arXiv:2605.04138
6. **N. Starkman**, J. Nibauer. *phasecurvefit: A High-Performance JAX Framework for Phase-Space Walks with Pluggable Metrics and Strategies.* Journal of Open Source Software SUBMITTED pyOpenSci review
5. S. Wu‡, **N. Starkman**, S. Pearson, J. Nibauer, J. Miro-Carretero, D. Martinez-Delgado. *Potamides: Mapping Dark Matter Halo Shapes from Stellar Stream Tracks in the Local Universe.* The Astrophysical Journal ACCEPTED ADS arXiv:2605.07809
4. S. Wu‡, **N. Starkman**, J. Nibauer, S. Pearson. *Potamides: JAX tools for curvature-based inference from stellar streams.* Journal of Open Source Software 11, 10712 10.21105/joss.10712

3. J. Nibauer, A. Bonaca, D. N. Spergel, A. M. Price-Whelan, J. E. Greene, **N. Starkman**, et al. *StreamSculptor: Hamiltonian Perturbation Theory for Stellar Streams in Flexible Potentials with Differentiable Simulations*. The Astrophysical Journal 983, 68 10.3847/1538-4357/adb8e8 ADS arXiv:2410.21174
2. **N. Starkman**, A. M. Price-Whelan, J. Nibauer. *unxt: A Python package for unit-aware computing with JAX*. Journal of Open Source Software 10, 7771 10.21105/joss.07771
1. **N. Starkman**, J. Nibauer, J. Bovy, J. Webb, K. Tavangar, A. Price-Whelan, et al. *Stream Members Only: Data-Driven Characterization of Stellar Streams with Mixture Density Networks*. The Astrophysical Journal 980, 253 10.3847/1538-4357/ad94f2 ADS arXiv:2311.16960

## Software Development

**phasecurvefit** 2026
Paths through phase space

**potamides** 2026
Constrain gravitational potentials from stellar stream curvature

**galax**
Galactic dynamics in JAX

**coordinax**
Coordinates in JAX

**unxt** 2025
Units in JAX

**quax**
Multiple dispatch in JAX

**Astropy** 2022
Astronomy in Python

## Invited Talks

Aug 2026 **Marche III: Big Bang, Big Stars, Big Computers (Jesi)** — Jesi, Italy
Energy Structures of Extragalactic Stellar Streams Reveal Dark Matter Halos

Jun 2026 **EAS 26-S10 (Lausanne)** — Lausanne, Switzerland
The Geometry of Dark Matter Halos from Extragalactic Streams

Feb 2026 **CWRU Seminar (Cleveland)** — Cleveland, OH, USA
Computationally Unscrambling EGGS (Extra-Galactic Gravity from Streams)

Nov 2025 **TevPA (Valencia)** — Valencia, Spain
The Geometry of Dark Matter Halos from Extragalactic Streams

Oct 2025 **DARK seminar (Copenhagen)** — Copenhagen, Denmark
The Geometry of Dark Matter Halos from Extragalactic Streams

Oct 2025 **Texas A&M Seminar (Texas)** — College Station, TX, USA
The Geometry of Dark Matter Halos from Extragalactic Streams

Sep 2025 **CCA Software seminar (NYC)** — New York, NY, USA
unxt, coordinax, and software development in JAX

Sep 2025 **Princeton Thunch Seminar (Princeton)** — Princeton, NJ, USA
Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams

## Mentoring

May 2026 **Reem Hamraz Google Summer of Code for Astropy**
Hardening Astropy's core stability

2025 – 2026 **Amir Abdul (Howard)**
Baryon Modeling in External Galaxies with Stellar Streams
Leadership Alliance National Symposium, July 23–25, 2025
2025 NSBP-NSHP Joint Annual Conference, November 19–23, 2025
2026 APS Global Physics Summit, March 14–20, 2026

2024 – 2026 **Charlotte Myers (MIT) with Prof. Lina Necib (MIT)**
Physics-Informed Neural Networks for Modeling Galactic Gravitational Potentials
NeurIPS Paper

## Peer Review

Journals — Astronomy & Astrophysics · The Astrophysical Journal · European Physical Journal C · Monthly Notices of the Royal Astronomical Society · Journal of Open Source Software (commensurability: a Python package for classifying astronomical orbits based on their toroid volume), Panels — National Science Foundation project funding panel