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📄 Publications 🔗 [arXiv](#) 📄 [Zenodo](#) 📄 0000-0003-3954-3291



## 🏛️ EDUCATION

- 2018 – 2024 **PhD in Astronomy & Astrophysics**, University of Toronto 🔗 Toronto, ON, Canada  
[NSERC CGS-D Fellow](#) 2020–2023. [NSERC CGS-M Fellow](#) 2019–2020.  
Thesis: Charting Stellar Streams of the Milky Way  
Supervisors: Jo Bovy, Jeremy Webb
- 2014 – 2018 **B.S. in Mathematical Physics and Astronomy**, Case Western Reserve University 🔗 Cleveland, OH, USA  
Summa Cum Laude.  
Supervisors: Stacy McGaugh

## 🏢 PROFESSIONAL APPOINTMENTS

- 2024 – 2027 **Postdoctoral Associate**, MIT Kavli Institute for Astrophysics and Space Research 🔗 Cambridge, MA, USA  
Brinson Prize Fellowship (2024–2027).
- 2021 – **Coordinator (2025 – 2028), Strategic Planner (2025 – 2026) & Core Developer**, Astropy 🔗 Remote  
Coordination Committee (executive committee), 2025–2028.  
Strategic Planning and Organizing Committee, 2025–2026.  
Member, Core Developer Team; lead maintainer for Cosmology, co-maintainer of Units.  
Funding: Astropy Cycle III — Cosmology and Quantity 2.0.  
Team awards: 2025 AAS Lancelot M. Berkeley–New York Community Trust Prize, the 2023 IOP Publishing Top Cited Paper Award and the 2022 ADASS Prize for an Outstanding Contribution to Astronomical Software.

## 🏆 GRANTS & FELLOWSHIPS

- Oct 2026 **Pacific Postdoc Program at the University of Washington**, Pacific Postdoc Program Fellow, University of Washington 🔗  
A one-month fellowship at the Dark Universe Science Center at the University of Washington in Seattle, funded by the Dark Universe Science Center and the Simons Institute.
- Feb 2024 **Brinson Prize Fellowship**, Prize Fellow, Brinson Foundation 🔗 USD 360,000  
“to support early-career astrophysicists and cosmologists who are committed to chasing bold ideas with creative, nimble, and innovative research.”
- Jul 2022 **Astropy Cycle III Funding Grant** 🔗 USD 12,000  
USD 12,000 NASA ROSES and Moore Foundation funding to Astropy Lead: “Cosmology in Astropy”
- Jul 2022 **Astropy Cycle III Funding Grants** 🔗 USD 8,000  
USD 8,000 NASA ROSES and Moore Foundation funding to Astropy Lead: “Quantity 2.0: unitful calculations beyond NumPy”
- 2019 – 2024 **Massey Junior Fellow**, Junior Fellow, Massey College  
University of Toronto's graduate college for those showing exceptional promise and engagement within academia and the world beyond it.
- 2018 – 2024 **University of Toronto Graduate Fellowship**, University of Toronto CAD 23,000–32,000 p.a.

## 🏆 AWARDS

- Jan 2025 **AAS Lancelot M. Berkeley–New York Community Trust Prize**, American Astronomical Society 🔗, to the *Astropy Collaboration*  
Team award, as a core developer and Coordination Committee member of Astropy.

- Jan 2024 **Finalist, ASA Astrostatistics Interest Group Student Paper Competition, ASA Astrostatistics Interest Group**   
to Nathaniel Starkman  
Finalist for Stream Members Only; presented at JSM 2024 (talk).
- Nov 2023 **IOP Publishing Top Cited Paper Award, North America, IOP Publishing**   
to the Astropy Collaboration  
Team award, as an author of the v5.0 paper: top 1% most-cited in Astronomy and Astrophysics.
- May 2022 **OSOTF HUDD Award at Massey, Massey College**   
Ontario Student Opportunity Trust Fund
- 2022 **ADASS Prize for an Outstanding Contribution to Astronomical Software, Astronomical Data Analysis Software and Systems**   
to the Astropy Project  
Team award, as a core developer of Astropy.

## PUBLICATIONS

Students I supervised or advised: [undergraduate<sup>†</sup>](#), [graduate<sup>‡</sup>](#).

19. **N. Starkman**, J. Nibauer, S. Pearson, **S. Wu<sup>‡</sup>**, L. Necib. *When Streams Curve Away: a Test of Dark Matter from Extragalactic Stellar Stream Populations*. The Astrophysical Journal SUBMITTED  [arXiv:2609.40057](#)
18. Euclid Collaboration, **N. Starkman**, J. Nibauer, S. Pearson, **S. Wu<sup>‡</sup>**, 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](#)
17. **C. Myers<sup>†</sup>**, **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](#) 
16. 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](#)
15. **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](#) 
14. **S. Wu<sup>‡</sup>**, **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](#)
13. **S. Wu<sup>‡</sup>**, **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](#) 
12. **C. Myers<sup>†</sup>**, **N. Starkman**, L. Necib. *Physics-Informed Neural Networks for Modeling Galactic Gravitational Potentials*. Advances in Neural Information Processing Systems (NeurIPS 2025)  [OpenReview](#) 
11. J. Nibauer, A. Bonaca, D. N. Spergel, A. M. Price-Whelan, J. E. Greene, **N. Starkman**, et al. *Stream-Sculptor: 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](#)
10. **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](#)  
9. **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](#)  
8. **N. Starkman**, G. Starkman, A. Kosowsky. *Angular Correlations of Cosmic Microwave Background Spectrum Distortions from Photon Diffusion*. Monthly Notices of the Royal Astronomical Society 529, 2274  [10.1093/mnras/stae665](#)  [arXiv:2310.01578](#)  
7. M. R. Blanton, ..., **N. Starkman**, et al. *The Future of Astronomical Data Infrastructure: Meeting Report*.  [arXiv:2311.04272](#)

6. **N. Starkman**, J. Bovy, J. Webb, D. Calvetti, E. Somersalo. *On the fast track: Rapid construction of stellar stream paths*. Monthly Notices of the Royal Astronomical Society 522, 5022  [10.1093/mnras/stad1166](https://doi.org/10.1093/mnras/stad1166)   [arXiv:2212.00949](https://arxiv.org/abs/2212.00949)
5. The Astropy Collaboration, A. M. Price-Whelan, P. L. Lim, N. Earl, **N. Starkman**, L. Bradley, D. L. Shupe, et al. *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 935, 167  [ADS](https://ui.adsabs.org/abs/2020ApJ...935..167STC)   [arXiv:2206.14220](https://arxiv.org/abs/2206.14220)
4. **N. Starkman**, J. S. Sidhu, H. Winch, G. Starkman. *Straight Lightning as a Signature of Macroscopic Dark Matter*. Physical Review D 103, 063024  [10.1103/PhysRevD.103.063024](https://doi.org/10.1103/PhysRevD.103.063024)   [arXiv:2006.16272](https://arxiv.org/abs/2006.16272)
3. **N. Starkman**, J. Bovy, J. Webb. *An extended Pal 5 stream in Gaia DR2*. Monthly Notices of the Royal Astronomical Society  [10.1093/mnras/staa534](https://doi.org/10.1093/mnras/staa534)   [arXiv:1909.03048](https://arxiv.org/abs/1909.03048)
2. P. Li, F. Lelli, S. S. McGaugh, **N. Starkman**, J. M. Schombert. *A constant characteristic volume density of dark matter haloes from SPARC rotation curve fits*. Monthly Notices of the Royal Astronomical Society  [10.1093/mnras/sty2968](https://doi.org/10.1093/mnras/sty2968)   [arXiv:1811.00553](https://arxiv.org/abs/1811.00553)
1. **N. Starkman**, F. Lelli, S. S. McGaugh, J. Schombert. *A new algorithm to quantify maximum discs in galaxies*. Monthly Notices of the Royal Astronomical Society 480, 2292  [10.1093/mnras/sty2011](https://doi.org/10.1093/mnras/sty2011)    [arXiv:1802.09967](https://arxiv.org/abs/1802.09967)

## SOFTWARE DEVELOPMENT

**Astropy**  2022 

Astronomy in Python

**coordinax** 

Coordinates in JAX

**potamides**  2026

Constrain gravitational potentials from stellar stream curvature

**galax**  

Galactic dynamics in JAX

**unxt**  2025 

Units in JAX

**phasecurvefit**  2026

Paths through phase space

**plum** 

Multiple dispatch in Python

**quax** 

Multiple dispatch in JAX

**galactoPINNs**  2026

Physics-informed neural networks for galactic potentials

## INVITED TALKS

|          |                                                                                                                                 |                          |
|----------|---------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Aug 2026 | <b>Marche III: Big Bang, Big Stars, Big Computers (Jesi)</b>                                                                    | Jesi, Italy              |
|          | Energy Structures of Extragalactic Stellar Streams Reveal Dark Matter Halos                                                     |                          |
| Jun 2026 | <b>EAS 26-S10 (Lausanne)</b>                 | Lausanne, Switzerland    |
|          | The Geometry of Dark Matter Halos from Extragalactic Streams                                                                    |                          |
| Feb 2026 | <b>CWRU Seminar (Cleveland)</b>                                                                                                 | Cleveland, OH, USA       |
|          | Computationally Unscrambling EGGS (Extra-Galactic Gravity from Streams)                                                         |                          |
| Nov 2025 | <b>TevPA (Valencia)</b>                                                                                                         | Valencia, Spain          |
|          | The Geometry of Dark Matter Halos from Extragalactic Streams                                                                    |                          |
| Oct 2025 | <b>DARK seminar (Copenhagen)</b>                                                                                                | Copenhagen, Denmark      |
|          | The Geometry of Dark Matter Halos from Extragalactic Streams                                                                    |                          |
| Oct 2025 | <b>Texas A&amp;M Seminar (Texas)</b>                                                                                            | College Station, TX, USA |
|          | The Geometry of Dark Matter Halos from Extragalactic Streams                                                                    |                          |
| Sep 2025 | <b>CCA Software seminar (NYC)</b>                                                                                               | New York, NY, USA        |
|          | unxt, coordinax, and software development in JAX                                                                                |                          |
| Sep 2025 | <b>Princeton Thunch Seminar (Princeton)</b>  | Princeton, NJ, USA       |
|          | Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                            |                          |
| Mar 2025 | <b>DARK seminar (Copenhagen)</b>                                                                                                | Copenhagen, Denmark      |
|          | Bayesian models for detecting streams in LSST data                                                                              |                          |
| Oct 2024 | <b>CWRU Seminar</b>                          | Cleveland, OH, USA       |
|          | Stream Members Only: Data-Driven Characterization of Stellar Streams for Inference on the Galactic Potential                    |                          |
| Jan 2023 | <b>CITA Seminar</b>                                                                                                             | Toronto, ON, Canada      |
|          | Astropy Cosmology: the Present and the Expanding Future                                                                         |                          |

## PRESENTATIONS

|          |                                                                                                                                                                                                                                           |                       |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| Aug 2026 | <b>New Frontiers in Cosmology (Talk)</b><br>Energy Structures of Extragalactic Stellar Streams Reveal Dark Matter Halos                                                                                                                   | A Coruña, Spain       |
| Jul 2026 | <b>Near Field Cosmology in the Era of Big Data (Talk)</b> <br>Energy Structures of Extragalactic Stellar Streams Reveal Dark Matter Halos              | Toronto, ON, Canada   |
| Jun 2026 | <b>DARK Seminar (Talk)</b><br>Energy Structures of Extragalactic Stellar Streams Reveal Dark Matter Halos                                                                                                                                 | Copenhagen, Denmark   |
| Jan 2026 | <b>York Seminar (Talk)</b><br>Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                                                                                                        | Toronto, ON, Canada   |
| Nov 2025 | <b>TeVPA (Talk)</b> <br>Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                             | Valencia, Spain       |
| Oct 2025 | <b>IAUS 403 (Talk)</b> <br>Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                          | Córdoba, Spain        |
| Sep 2025 | <b>Cosmology 2025 (Talk)</b> <br>Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                    | Portoferraio, Italy   |
| Sep 2025 | <b>MKI Journal Club (Talk)</b><br>Euclid: The Geometry of Dark Matter Halos from Extragalactic Streams                                                                                                                                    | Cambridge, MA, USA    |
| May 2025 | <b>DDA #56</b> <br>Extra-Galactic Gravity using Streams (EGGS) from Euclid's Zoo(niverse)                                                                | Atlanta, GA, USA      |
| May 2025 | <b>Euclid LU-SWG (Talk)</b><br>Extra-Galactic Gravity using Streams (EGGS) from Euclid's Zoo(niverse)                                                                                                                                     | Lausanne, Switzerland |
| Aug 2024 | <b>ASA: Astrostatistics Interest Group Paper Competition</b> <br>Stream Members Only: Data-Driven Characterization of Stellar Streams                | not attended          |
| Aug 2024 | <b>Streams 24: The theory edition (Talk)</b> <br>From JAX to Galax, a new generation of stellar stream tools Using ML to select stellar stream members | Durham, UK            |
| May 2024 | <b>Division on Dynamical Astronomy #55 (Talk)</b> <br>Stream Members Only: Data-Driven Characterization of Stellar Streams                             | Toronto, ON, Canada   |
| May 2024 | <b>Globular Clusters and Their Tidal Tails (Talk)</b> <br>Stream Members Only: Data-Driven Characterization of Stellar Streams                         | Toronto, ON, Canada   |
| Oct 2023 | <b>DESC sprint week</b>                                                                                                                                                                                                                   | Pittsburgh, PA, USA   |
| May 2023 | <b>Astropy Conference (Talk)</b><br>An Interoperable Future with Astropy                                                                                                                                                                  | Cambridge, MA, USA    |
| Mar 2023 | <b>IAUS379: Dynamical Masses of Local Group Galaxies (Poster)</b> <br>Stellar Stream Track Reconstruction, with Errors                                 | Potsdam, Germany      |
| Jan 2023 | <b>AAS 2023 (Talk)</b><br>Astropy Tutorials on Units & Constants                                                                                                                                                                          | Seattle, WA, USA      |
| Oct 2022 | <b>CATS-2022</b> <br>Streams22: A workshop for assembling a Community Atlas of Tidal Streams                                                           | Pasadena, CA, USA     |

## CONFERENCES

|          |                                                                                                                                                                   |             |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
| Sep 2026 | <b>Astropy 2026 Conference</b><br>Role: Coordination Committee and Strategic Planning Committee; moderated online discussion and helped moderate the AI sessions. | Online      |
| Aug 2026 | <b>Astrophysics and Space Science in Marche III: Big Bang, Big Stars, Big Computers</b><br>Role: SOC                                                              | Jesi, Italy |

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|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|
| Jan 2026 | <b>Gaia Hackathon</b>                                                                                                          | Cambridge, MA, USA  |
|          | Role: LOC                                                                                                                                                                                                      |                     |
| Jun 2025 | <b>Astropy Coordination Meeting</b>                                                                                           | Santa Cruz, CA, USA |
|          | Role: SOC                                                                                                                                                                                                      |                     |
| May 2025 | <b>Division of Dynamical Astronomy #56</b>   | Atlanta, GA, USA    |
|          | Role: SOC                                                                                                                                                                                                      |                     |
| Jan 2025 | <b>Gaia Hackathon</b>                                                                                                         | Cambridge, MA, USA  |
|          | Role: LOC                                                                                                                                                                                                      |                     |
| Oct 2024 | <b>JAXtronomy Workshop</b>                                                                                                    | New York, NY, USA   |
|          | Role: SOC                                                                                                                                                                                                      |                     |
| Jun 2024 | <b>Astropy Core Developer Conference</b>                                                                                                                                                                       | Santa Cruz, CA, USA |
| May 2024 | <b>From JAX to Galax</b>                                                                                                      | Toronto, ON, Canada |
|          | Workshop at Globular Clusters and Their Tidal Tails                                                                                                                                                            |                     |
| Feb 2023 | <b>The Future of Astrophysical Data Infrastructure</b>                                                                        | Online              |
| Mar 2022 | <b>Astropy Core Developer Conference (Talk)</b>                                                                                                                                                                | Boston, MA, USA     |
|          | The future of interoperability with Python's Protocols Role: Core developer, maintainer for Astropy Cosmology and Units                                                                                        |                     |

## MENTORING

|             |                                                                                                                                          |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------|
| May 2026    | <b>Reem Hamraz Google Summer of Code for Astropy</b>  |
|             | Hardening Astropy's core stability                                                                                                       |
| 2025 – 2026 | <b>Amir Abdul (Howard)</b>                                                                                                               |
|             | 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                                                                                        |
| 2025 – 2026 | <b>Taisiia Karasova (MIT) with Prof. Lina Necib (MIT)</b>                                                                                |
|             | Machine Learning Galaxy intrinsic sizes                                                                                                  |
| 2024 – 2026 | <b>Charlotte Myers (MIT) with Prof. Lina Necib (MIT)</b>                                                                                 |
|             | Physics-Informed Neural Networks for Modeling Galactic Gravitational Potentials                                                          |
|             | NeurIPS Paper                                                                                                                            |
| 2023 – 2025 | <b>Connor McKeigan (Astronomy, UofT) with Prof. Ting Li (UofT)</b>                                                                       |
|             | Undergraduate thesis project: “Characterizing the stellar streams of S <sub>5</sub> ”                                                    |
| 2019 – 2022 | <b>Massey Tutoring Program</b>                                                                                                           |
|             | Volunteer math and physics tutor to prospective first-generation college students                                                        |
|             | 2019, 2020 and 2022.                                                                                                                     |

## TEACHING

|             |                                                                                                                                                                     |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2019 – 2020 | <b>Lead Observer: AST101-325</b> , University of Toronto                                                                                                            |
|             | Role: Trained and liaised with TAs and students in all courses using the campus telescope facilities.                                                               |
| 2019 – 2024 | <b>TA, AST 201: Stars and Galaxies</b> , University of Toronto                                                                                                      |
|             | Role: Designed and ran weekly course tutorial sections, created exam questions, proctored exams, and graded course projects.                                        |
|             | 2019, 2021–2024.                                                                                                                                                    |
| 2018 – 2023 | <b>TA, AST 101: The Sun and its Neighbours</b> , University of Toronto                                                                                              |
|             | Role: Designed and ran weekly course tutorial sections, planetarium shows, & observing nights; created exam questions, proctored exams, and graded course projects. |
|             | 2018, 2021–2023.                                                                                                                                                    |

## 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

## PROFESSIONAL SERVICE

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- 2022 – 2023 **Massey House Committee**  
Junior Fellow governance committee at Massey college.
- 2019 – 2024 **MasseyScope Committee Member**, Massey College  
Organizing astronomy outreach with a focus on underprivileged communities
- 2019 – 2020 **Sigma Nu Alumni Advisory Board**  
Role: Member of the Sustainability and Chapter Operations committees
- 2018 – **Canadian Astronomical Society (CASCA)**, Canadian Astronomical Society

## OUTREACH

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- Aug 2026 **Public Talk in Jesi, Italy**, Astrophysics and Space Science in Marche III [🔗](#)
- Oct 2021 **Origins Science Scholars Lecture Series**, Origins Science Scholars program, Case Western Reserve University Online  
Science of Origins: Dark Matter and the Milky Way
- 2019 – 2021 **AstroTours Telescope Organizer**, Dunlap Institute for Astronomy & Astrophysics, University of Toronto [🔗](#)  
Organizer for all telescope outreach in Dunlap's public event
- 2019 – 2022 **Massey Telescopes Outreach Coordinator**, Massey College  
Organizing committee member for astronomy outreach and appreciation at Massey College
- 2019 **Planet Party Toronto Volunteer**, Department of Astronomy and Astrophysics, University of Toronto
- 2018 – 2020 **Astronomy on Tap Toronto Volunteer**, Department of Astronomy and Astrophysics, University of Toronto
- 2018 – 2019 **AstroTours Planetarium Presenter**, Dunlap Institute for Astronomy & Astrophysics, University of Toronto  
Regular planetarium show designer and presenter for Dunlap's AstroTours public outreach
- 2018 – 2021 **AstroTours Toronto Outreach Volunteer**, Dunlap Institute for Astronomy & Astrophysics, University of Toronto

## MEDIA

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- Feb 2023 **The New Scientist**, The New Scientist [🔗](#)  
Featured in article on various strategies to detect dark matter, including the method from my paper
- May 2021 **Smithsonian Feature Article**, Smithsonian Feature Article [🔗](#)  
Interviewed for feature article about my paper