Yarone Meir Tokayer

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Email: yarone.tokayer@yale.edu
Website: www.yaronetokayer.com
ORCID: 0000-0002-0430-5798
Github: github.com/yaronetokayer

Education

Yale University — New Haven, CT
Ph.D., Physics, Advisor: Frank van den Bosch — exp. 2027
Thesis: "Probing the dynamical structure of dark matter halos using N-body and analytical techniques"
M.S. and M.Phil — May 2023

Columbia University — New York, NY
M.A., Philosophical Foundations of Physics, Advisor: David Z. Albert — Feb. 2020
Thesis: "Probability in Everettian Quantum Mechanics"

The Cooper Union — New York, NY
B.S., Engineering, Minor in Mathematics, *summa cum laude* — May 2014
Senior Project: "Muscle Denervation and Neurotensin as a Therapeutic Target for ALS"

Skills and Languages

- **Programming languages:** Python, MATLAB, C++, HTML/CSS, FORTRAN
- **Software & tools:** NASA HEASoft, Mathematica, Latex, LabVIEW, Excel
- **N-body code:** `gyrfalcON`, `Agama`
- **Python Libraries:**
  Astronomy: `Astropy`, `Stingray`, `PyXSPEC`
  Data and Visualization: `Pandas`, `NumPy`, `MatPlotlib`
- **Telescope data:** *Chandra*, *Swift*, *NuSTAR*, *NICER*
- **Ground telescope observing experience:**
  Palomar: Double Spectrograph, TripleSpec
  Keck: NIRC2+AO, OSIRIS+AO
- **Design tools:** Arduino, Microchip PIC, AutoCAD, SolidWorks, laser cutting
- **Spoken languages:** English (native), Hebrew (fluent), Yiddish (basic), German (basic)

Research Experience

Modeling the dynamical structure of dark matter halos — Jun. 2024–Present
Graduate Research Assistant, PI: Frank van den Bosch — Yale University
Theoretical and computational astrophysics.

- *Developed gravothermal fluid codes to model stellar mass segregation and SIDM core collapse.*
- *Implemented idealized N-body code to model CDM halo growth and compare with cosmological predictions.*

Quantifying Selection Effects in Deep-Field AGN Surveys Using BASS — Jul. 2021–Aug. 2024
Graduate Research Assistant, PIs: Michael Koss, C. Megan Urry — Yale University
Extra-galactic high energy astrophysics.

- *Developed simulation data pipeline to generate and fit high-z Chandra AGN spectra.*
- *Spectral analysis of 2800 simulated spectra to quantify Chandra bias.*
- *Work published in ApJ; poster presented at the Jan. 2023 AAS meeting.*

Constraining Dark Matter Profiles with GGSL Measurements — Jan. 2022–May 2024
Graduate Research Assistant, PI: Priyamvada Natarajan — Yale University
Data-driven cosmology.

– *Developed fitting algorithms for cluster DM subhalo profiles from lensing measurements.*
– *Derived empirical c-M relation, furthering ΛCDM tension.*
– *Work published in ApJ.*

Galactic X-ray astronomy data analysis Mar. 2020–Dec. 2020
Research Assistant, PIs: Charles Hailey, Kaya Mori Columbia University
Galactic high energy astrophysics.

– *Timing analysis of NICER observations of AR Scorpii. Sub-μs precision spin measurement; found pulsed non-thermal emission in X-ray band.*
– *Imaging analysis of NuSTAR observations of the "Eel Nebula." Discovered synchrotron burnoff effect in the PWN and evidence of a shock feature. Work published in ApJ.*
– *Spectral and timing analysis of NuSTAR observations of HESS J0632+057. Work published in ApJ.*

Assembly and testing of detector modules for GAPS experiment Aug. 2019–Feb. 2020
Research Assistant, PI: Charles Hailey Columbia University
Experimental particle astrophysics.

– *Fabrication, testing, and assembly of Si(Li) detector array modules for GAPS flight (2022); aims to detect antimatter evidence of DM annihilation in the galactic halo.*

ALS pathology in mouse and cell culture models Sep. 2013–May 2014
Research Assistant, PI: Christopher Henderson; Supervisor: Dima Yudin Columbia Univ. Med. Ctr
Molecular and Cellular Neurobiology.

– *Senior capstone project: ALS pathology in mouse and cell culture models. Immunohistochemistry to measure denervation over time. Optimization of embryonic stem cell-derived motor neuron cultures to test trophic factors.*

Lung Perfusion Bioreactor Jan. 2011–May 2011
Undergraduate Researcher, PIs: Eric Lima, Gordana Vunjak-Novakovic Cooper Union/Columbia University Med. Ctr
– *Designed and built prototype used for testing on swine lung.*

Publications and Posters

A complete list of publications can also be found on Google Scholar.

Refereed Journal Publications

1. **Tokayer, Y. M.**, Koss, M., Urry, C. M., et al., *ApJ*, 982, 134 (2025). doi:10.3847/1538-4357/adb8c9
2. **Tokayer, Y. M.**, Dutra, I., Natarajan, P., et al., *ApJ*, 970, 143 (2024). doi:10.3847/1538-4357/ad51fd
3. Guolo, M., Gezari, S., Yao, Y., et al. (incl. **Tokayer, Y. M.**), *ApJ*, 966, 160, (2024). doi:10.3847/1538-4357/ad2f9f
4. Burgess, D., Mori, K., Gelfand, J. D., et al. (incl. **Tokayer, Y. M.**), *ApJ*, 930, 148, (2022). doi:10.3847/1538-4357/ac650a
5. **Tokayer, Y. M.**, An, H, Halpern, J. P., et al., *ApJ*, 923, 17, (2021). doi:10.3847/1538-4357/ac2c6a

Conference Posters

6. **Tokayer, Y. M.**, Koss, M., Urry, C. M., et al., Quantifying Selection Effects in Deep-Field AGN Surveys with BASS. In: *241st Meeting of the AAS*, January 8–12, 2023. Seattle, WA. Link to poster.

7. Woo, J., An, H., Burgess, D., et al. (incl. **Tokayer, Y. M.**), Multi-wavelength Study of PeVatron Candidate Pulsar Wind Nebulae. In: *AAS/High Energy Astrophysics Division 19th Annual Meeting*, March 13–17, 2022. Pittsburgh, PA.

8. Saffold, N., **Tokayer, Y. M.**, Mori, K., A NICER X-ray View of White Dwarf Pulsar AR Scorpii. In: *237th Meeting of the AAS*, January 10–15, 2021. Virtual.
Link to poster.

Academic Presentations

Invited Talks

9. "Core-collapsed SIDM halos as massive SMBH seeds," Hebrew University Cosmolunch; Apr. 24, 2025. Jerusalem, Israel.

10. "The Unified AGN Model in X-ray observations," Columbia University High-Energy Astrophysics Meeting; Jan. 28, 2022. Virtual.

Conference Talks

11. "Core-collapsed SIDM halos as massive SMBH seeds," YCIU Workshop; May 30, 2025; New Haven, CT.

12. "Using BASS to Detect Obscuration Bias and Test AGN Fitting Models for Low Count Data," BASS2024: New Horizons for Understanding Nearby AGN; April 22, 2024; Virtual.

13. "Quantifying AGN Selection Effects in the Chandra COSMOS-Legacy Survey with BASS," Accretion History of AGN (AHA) III Workshop; December 15, 2023; Miami, FL.

14. "Quantifying Selection Effects in Deep-Field AGN Surveys," New England Regional Quasar and AGN Meeting (NERQUAM); May 6, 2022; Storrs, CT.

15. Saffold, N., **Tokayer, Y. M.**, "A NICER X-ray View of White Dwarf Pulsar AR Scorpii," Spring 2021 NICER Data Analysis and Science Workshop; May 13, 2021. Virtual.
Video of presentation.

Accepted Proposals

16. Co-Investigator. Ref #GN-2024A-Q-138 for Gemini GMOS Observations. *Resolving Mrk 248: A Potential Triple AGN with a Hidden 500 pc Dual AGN.*
PI: Michael Koss

17. Co-Investigator. Proposal 8087 for NuSTAR Observations. *A Survey of the Most Luminous Hard X-ray Selected Obscured Quasars at z=0.2-0.4.*
PI: Michael Koss

18. Co-Investigator. Proposals 90296 and 094349 for XMM-Newton Observations. *A Survey of the Most Luminous Hard X-ray Selected Obscured Quasars at z=0.2-0.4.*
PI: Michael Koss

Conferences, Workshops, and Summer Schools Attended

- **Yale Center for the Invisible Universe (YCIU) Workshop**
Yale University. May 30, 2025. New Haven, CT.
- **Accretion History of AGN (AHA) III Workshop**
University of Miami. December 14–17, 2023. Miami, FL.

- **Cosmology Summer School**
  University of Michigan. June 5–9, 2023. Ann Arbor, MI.
- **241st Meeting of the AAS**
  January 8–12, 2023. Seattle, WA.
- **New England Regional Quasar and AGN Meeting (NERQUAM)**
  University of Connecticut. May 6, 2022. Storrs, CT.
- **NICER Data Analysis and Science Workshop**
  May 13, 2021. Virtual.

Teaching

Leitner Observatory and Planetarium

Planetarium Presenter — January 2024–Present

-Write and present planetarium shows using night sky simulation for groups spanning pre-K to adult
-Design and deliver classroom presentations about astronomy and outer space for school groups K-12
-Run telecope demonstrations for evening groups

Yale University

Course design

-Designed, wrote lecture slides and problem sets for undergraduate course in Cosmology (ASTR 170); Instructor: Priyamvada Natarajan — *Summer/Fall 2024*

Graduate Teaching Fellow

-Introduction to Mathematical Methods of Physics (PHYS 301, PHYS 4000) — *Fall 2022, Fall 2025*
-Graduate Statistical Physics I (PHYS 512) — *Spring 2024, Spring 2025*
-Graduate Classical Mechanics (PHYS 500) — *Fall 2024*
-University Physics for the Life Sciences (PHYS 171) — *Spring 2023*
-General Physics Laboratory II (PHYS 166L/S166) — *Spring 2022, Summer 2022*
-General Physics Laboratory I (PHYS 165L) — *Fall 2021*

SAR High School

Chemistry Teacher — Spring 2021

-Taught four 10^{th} grade chemistry sections spanning three levels from remedial to honors

Physics Teacher and Advisor — Fall 2014–Spring 2019

-Designed curriculum and taught 4 physics courses on two tracks for 11^{th} and 12^{th} grade
-Taught 11 grade Jewish Philosophy course, 9 and 11 grade Jewish text study
-10^{th} grade advisor
-Designed and oversaw engineering-related elective and co-curricular programming
-Coached robotics team that won second place in robotics competition at the Technion in Haifa, Israel

Naaleh High School for Girls

STEM Teacher — Fall 2019–Spring 2020

-Wrote curriculum and taught a course in computer programming and engineering design
-Designed and instructed Python coding co-curricular; club was a member of Girls Who Code

The Cooper Union

Teaching Assistant — Fall 2011

-Introductory Physics Lab (PH291)

Community Engagement and Outreach

Service

Graduate Student Mentor, Yale Undergraduate Mentorship Initiative 2025–Present

Co-Founder and Organizer, History and Foundations of Physics Reading Group 2022–Present

Board of Trustees, Slifka Center for Jewish Life at Yale 2023–2024

Graduate Student Representative, Physics Department Faculty Hiring Committee Spring 2023

Outreach

Astronomy on Tap Fall 2022
-Astronomy nights at a New Haven bar, featuring trivia and talks by members of the Yale Astronomy Department.

Super Science Showdown, Yale Open Labs Spring 2022
-Interactive science events for students in grades 6-8 in New Haven County.

Engineers as Teachers, Iridescent and Cooper Union Spring 2011
-Wrote and built interactive lesson plans on the topic of sound and music
-Lessons were taught at family science nights in local NYC middle school

Public Talks

1. "Are we alone? The new search for other worlds and habitable planets beyond the Solar System," SAR High School; Apr. 17, 2024; Riverdale, NY.
   Video of talk.

2. "The hype is real: what we are already learning from the most powerful telescope in human history," SAR High School; Jan. 4, 2023; Riverdale, NY.
   Video of talk.

Awards and Scholarships

- **Leigh Page Award for Excellence in Graduate Student Teaching**
  Yale University Physics Department, 2025
- **Teacher Award**
  2017 Robotraffic Competition at the Technion in Haifa, Israel, as coach to the SAR High School team
- **Entrance Scholarship**
  Philosophical Foundations of Physics Program, Columbia University, Fall 2016
- **Tau Beta Pi**
  Engineering Honors Society
- **Goodman Prize**
  Cooper Union, Spring 2013
- **Dean's List**
  Cooper Union, all semesters