# Yarone Meir Tokayer

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## 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 (en route) — 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, GPA: 3.9, *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

**Exploring the dynamical structure of dark matter halos** — Jun. 2024–Present
**Graduate Research Assistant**, PI: Frank van den Bosch — Yale University

*Using numerical and analytical methods to explore the structure and dynamics of DM halos.*

- *Developed model of CDM halo growth to compare with analytical predictions.*
- *Develop gravothermal fluid codes to predict SIDM collapse.*

**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. Simulated low-redshift BASS AGN X-ray spectra at higher redshifts to detect bias in Chandra deep field AGN surveys*

- *Developed simulation data pipeline to generate Chandra AGN spectra at high redshifts redshifts using Python and XSPEC.*
- *Spectral analysis of 2800 simulated spectra to quantify bias in Chandra-COSMOS Legacy Survey.*
- *Work published in ApJ; poster presented at the Jan. 2023 meeting of the American Astronomical Society*

**Constraining Dark Matter Profiles with GGSL Measurements** Jan. 2022–May 2024
**Graduate Research Assistant**, PI: Priyamvada Natarajan Yale University

*Using galaxy-galaxy strong lensing measurements to constrain cluster subhalo dark matter density profiles.*

- *Developed fitting algorithms in Python to find best fit DM profiles to cluster subhalos.*
- *Derived empirical c-M relation, which furthers tension between ΛCDM cosmological simulations and lensing observations on galaxy-scales, and is consistent with overefficient lensing observations.*
- *One paper published in ApJ; One paper in preparation.*

***NuSTAR* Group, Columbia Astrophysics Laboratory** Mar. 2020–Dec. 2020
**Research Assistant**, PIs: Charles Hailey, Kaya Mori Columbia University

*Investigations in galactic high energy astrophysics.*

- *Timing analysis of NICER observations of AR Scorpii, the only known "white dwarf pulsar" system. Measured spin period to sub-μs precision; found pulsed non-thermal emission in X-ray band.*
- *Imaging analysis of NuSTAR observations of the "Eel Nebula" (PWN G18.5-0.4). Revealed synchrotron burnoff effect in the PWN and found evidence of a shock feature. Work published in ApJ.*
- *Spectral and timing analysis of NuSTAR observations of the TeV binary HESS J0632+057. Work published in ApJ.*

***GAPS* Group, Columbia Astrophysics Laboratory** Aug. 2019–Feb. 2020
**Research Assistant**, PI: Charles Hailey Columbia University

*Fabrication, testing, passivation, and assembly of Si(Li) detector array modules to be used in GAPS flight (2022), which aims to detect antimatter evidence of dark matter annihilation in the galactic halo.*

**Motor Neuron Center, Columbia University Medical Center** Sep. 2013–May 2014
**Research Assistant**, PI: Christopher Henderson; Supervisor: Dima Yudin Columbia University

*Senior capstone project: ALS pathology in mouse and cell culture models.*

- *Immunohistochemistry of neuro-muscular junction sites to measure denervation in ALS mouse models over time across the body.*
- *Optimization of embryonic stem cell-derived motor neuron cultures to determine the effect of various trophic factors.*

**Lung Perfusion Bioreactor** Jan. 2011–May 2011
**Undergraduate Researcher**, Faculty: Eric Lima (Cooper Union), Gordana Vunjak-Novakovic (CUMC) Cooper Union/Columbia University

*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., BASS XLV: Quantifying Active Galactic Nuclei Selection Effects in the Chandra COSMOS-legacy Survey with BASS. *The Astrophysical Journal*, 982, 134, March 2025 doi:10.3847/1538-4357/adb8c9

2. **Tokayer, Y. M.**, Dutra, I., Natarajan, P., et al., The galaxy-galaxy strong lensing cross section and the internal distribution of matter in ΛCDM substructure. *The Astrophysical Journal*, 970, 143, July 2024. doi:10.3847/1538-4357/ad51fd

3. Guolo, M., Gezari, S., Yao, Y., et al. (incl. **Tokayer, Y. M.**), A systematic analysis of the X-ray emission in optically selected tidal disruption events: observational evidence for the unification of the optically and X-ray selected populations. *The Astrophysical Journal*, 966, 160, May 2024.
doi:10.3847/1538-4357/ad2f9f

4. Burgess, D., Mori, K., Gelfand, J. D., et al. (incl. **Tokayer, Y. M.**), The Eel Pulsar Wind Nebula: a PeVatron-Candidate Origin for HAWC J1826−128 and HESS J1826−130. *The Astrophysical Journal*, 930, 148, May 2022.
doi:10.3847/1538-4357/ac650a

5. **Tokayer, Y. M.**, An, H, Halpern, J. P., et al., Contemporaneous Multi-Wavelength Campaign to Study HESS J0632+057s Distinctive Light Curve. *The Astrophysical Journal*, 923, 17, Dec. 2021.
doi:10.3847/1538-4357/ac2c6a

*Papers in Preparation*

6. **Tokayer, Y. M.**, Natarajan, P., Meneghetti, M., et al., The concentration-mass relation of cluster substructures in ΛCDM. In prep for *The Astrophysical Journal*.

*Conference Posters*

7. **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.

8. 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.

9. 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*

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

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

*Conference Talks*

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

13. "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.

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

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

16. 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.
- **241$^{st}$ 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

*-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*
*-Introduction to Mathematical Methods of Physics (PHYS 301)* — *Fall 2022*
*-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 11th and 12th grade*
*-Taught 11 grade Jewish Philosophy course, 9 and 11 grade Jewish text study*
*-10th 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*

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

**Physics Department Faculty Hiring Committee**, Graduate Student Representative — 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