

# Yarone Meir Tokayer

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## EDUCATION

### Yale University

Ph.D., Physics, Advisor: Frank van den Bosch

Thesis: “Probing the dynamical structure of dark matter halos using N-body and analytical techniques”

M.S. and M.Phil (en route)

New Haven, CT

exp. 2027

Dec. 2024

### Columbia University

M.A., Philosophical Foundations of Physics, Advisor: David Z. Albert

Thesis: “Probability in Everettian Quantum Mechanics”

New York, NY

Feb. 2020

### The Cooper Union

B.S., Engineering, Minor in Mathematics, GPA: 3.9, *summa cum laude*

Senior Project: “Muscle Denervation and Neurotensin as a Therapeutic Target for ALS”

New York, NY

May 2014

## SKILLS AND LANGUAGES

- **Programming languages:** Python, MATLAB, C++, HTML
- **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 (intermediate), German (beginner)

## RESEARCH EXPERIENCE

### Exploring the dynamical structure of dark matter halos

Jun. 2024—Present

Graduate Research Assistant, PIs: Frank van den Bosch, Zhaozhou Li

Yale University

*Using numerical and analytical methods to explore the origins of the dynamical structure of dark matter halos, including the NFW profile.*

– *Item here.*

### 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  $\Lambda$ CDM cosmological simulations and lensing observations on galaxy-scales, and is consistent with overefficient lensing observations.*
- *One paper published in ApJ; One paper in preparation.*

- 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.*  
 – *Paper in preparation; poster presented at the Jan. 2023 meeting of the American Astronomical Society*
- 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- $\mu$ s 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), Cooper Union/Columbia University  
 Gordana Vunjak-Novakovic (CUMC)  
*Designed and built prototype used for testing on swine lung.*

## PUBLICATIONS AND POSTERS

### Refereed Journal Publications

1. **Tokayer, Y. M.**, Dutra, I., Natarajan, P., et al., The galaxy-galaxy strong lensing cross section and the internal distribution of matter in  $\Lambda$ CDM substructure. *The Astrophysical Journal*, 970, 143, July 2024.  
 doi:[10.3847/1538-4357/ad51fd](https://doi.org/10.3847/1538-4357/ad51fd)
2. 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](https://doi.org/10.3847/1538-4357/ad2f9f)
3. 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](https://doi.org/10.3847/1538-4357/ac650a)

4. **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](https://doi.org/10.3847/1538-4357/ac2c6a)

#### *Papers in Preparation*

5. **Tokayer, Y. M.**, Koss, M., Urry, C. M., et al., Quantifying AGN Selection Effects in the Chandra COSMOS-Legacy Survey with BASS. Submitted to *The Astrophysical Journal*.
6. **Tokayer, Y. M.**, Natarajan, P., Meneghetti, M., et al., The concentration-mass relation of cluster substructures in  $\Lambda$ CDM. 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: *241<sup>st</sup> 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 19<sup>th</sup> 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: *237<sup>th</sup> Meeting of the AAS*, January 10–15, 2021. Virtual.  
[Link to poster.](#)

## ACADEMIC PRESENTATIONS

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#### *Invited Talks*

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

#### *Conference Talks*

11. “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.
12. “Quantifying AGN Selection Effects in the Chandra COSMOS-Legacy Survey with BASS,” [Accretion History of AGN \(AHA\) III Workshop](#); December 15, 2023; Miami, FL.
13. “Quantifying Selection Effects in Deep-Field AGN Surveys,” [New England Regional Quasar and AGN Meeting \(NERQUAM\)](#); May 6, 2022; Storrs, CT.
14. 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

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15. 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
16. 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
17. 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

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- **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<sup>st</sup> 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

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### Yale University

#### Course design

-Redesigned, 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 2025, Spring 2024  
-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<sup>th</sup> 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<sup>th</sup> and 12<sup>th</sup> grade  
-Taught 11 grade Jewish Philosophy course, 9 and 11 grade Jewish text study  
-10<sup>th</sup> 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 2021

-Introductory Physics Lab (PH291)

## COMMUNITY ENGAGEMENT AND OUTREACH

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### Service

Slifka Center for Jewish Life at Yale, Board of Trustees

2023—Present

## Outreach

**Leitner Family Observatory and Planetarium**, Yale University Spring 2024—Present  
*-Planetarium and classroom presentations for visiting schools and groups.*

**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

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- **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