Yarone Meir Tokayer

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Education

Yale University — New Haven, CT
Ph.D., Physics, Advisor: Frank van den Bosch — exp. 2027
Thesis: Title TBD
M.S. and M.Phil (en route) — Dec. 2024

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
- **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)

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, includins 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 ΛCDM cosmological simulations and lensing observations on galaxy-scales, and is consistent with overefficient lensing observations.*
- *One paper submitted to 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-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

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 ΛCDM substructure. *The Astrophysical Journal*, 970, 143, July 2024. doi: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

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

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

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 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. "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

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

- **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

Yale University

Course design

-Redesigned and prepared undergraduate course in Cosmology (ASTR 170) — *Summer/Fall 2024*
Instructor: Priyamvada Natarajan

Graduate Teaching Fellow

-Graduate Classical Mechanics (PHYS 500) — *Fall 2024*
-Graduate Statistical Physics I (PHYS 512) — *Spring 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 10th 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 2021
-Introductory Physics Lab (PH291)

Community Engagement and Outreach

Service

Slifka Center for Jewish Life at Yale, Board of Trustees — 2023—Present

Physics Department Faculty Hiring Committee, Graduate Student Representative Spring 2023

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

- **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