Matthew T. Scoggins

Education

2021– **PhD** Astrophysics — Columbia University, New York, NY

2015–2020 **BS** Physics, Math, **BA** Philosophy — Western Washington University, Bellingham WA

Positions

2021– **Graduate Researcher** — Columbia University, New York, NY

- Supermassive star formation and their role in seeding supermassive black holes
- Learning the Universe: Using machine learning to accelerate forward modeling of cosmological simulations
- Observable consequences of the heavy seed origin for supermassive black holes
- SETI: Numerical investigations of star-lifting, identifying observable features of star-lifting
- Advised by Zoltan Haiman, Greg Bryan, David Kipping

2021-2023 **Graduate Teaching Assistant** — Columbia University, New York, NY

2015–2021 **Undergraduate Researcher** — Western Washington University, Bellingham, WA

Honors & Awards

2023-2024 **Explore Computing Time:** 400,000 CU — ACCESS

2022-2023 **Edith and Robert Fehr Fellowship** — Columbia U.

2020 **Magna Cum Laude in both BS & BA** — WWU

2019 **Material Science Undergraduate Research Grant** — WWU

2018-2019 **Oscar Edwin Olson Scholarship (x2)** — WWU

2018 **Willard A. and Anne W. Brown Astronomy Scholarship** — WWU

2018 **Summer Student Research Stipend** — WWU

Software

star_lifting — **Repository**

- A MESA wrapper which evolves the star with a time-depedent mass loss rate, keeping flux on a habitable planet constant.

qubit_simulation — **Repository**

- Simulating the evolution of a superconducting chip with the goal of finding patterns in the optimal protocols (values of the controls over time which evolve an initial state into a target state in the shortest possible time) over a variety of initial and target combinations.

no_wave_qm — **Repository**

- Simulating the evolution according to a hamilton-jacobi formulation of QM which replaces the wave with a configuration space density and equations of motion. Trajectory tracking using a 4-th order Runge Kutta technique.

Teaching & Service

2023	**Journal Reviewer:** ApJ, A&A	
2023-	**Associate Director:** Student Training in Astronomy Research (STARs)	Columbia University
2021-2023	**Graduate Teaching Assistant**	Columbia University
2020-2021	**Mathematics Teaching Assistant**	WWU
2017-2020	**Physics Teaching Assistant**	WWU
2019	**Student Faculty Hiring Committee**	WWU
2018-2019	**Physics Study Group Facilitator**	WWU
2018-2019	**Math Tutoring Fellow**	WWU

Mentoring

2024- **STARs program**

— Co-advising with another Graduate student, Daniel Yahalomi
— Three highschool students are using NASA's Meteoroid Engineering Model (MEM) code to measure the impact rates of debris on the lunar surface, with the goal of determining the shielding needed for the Artemis mission.

2023 **Undergraduate Students**

— Andrea Dubbels - Abnormal Photometry in the GAIA DR3 Catalog

2023-2025 **High School Students**

— Students took part in 2-12 month projects designed to expose them to research, typically within astronomy. Some projects have been (or will be) submitted to high school journals.
— Junhao Lei (early acceptance to Cornell) - A review of dark matter (accepted, International Journal of High School Research)
— Iulia Achim - Exploring the potential for habitability around a black hole (under review, Journal of Emerging Investigators)
— Jai Nair - Searching for biosignatures in nearby exoplanets (in prep)
— Estefania Olaiz - A new triple star system.
— Pratham Aggarwal - The origins of supermassive black holes
— Jiarui Shi, Hiep Duc Nguyen, Weibo Qin, Elenes Diana, William Li

Publications

– **Scoggins, M. T.**, Ho, M., Villaescusa-Navarro, F., Jamieson, D., et al., 2025, Learning the Universe: 3Gpc/h Tests of a Field Level N-body Simulation Emulator, Submitted to MNRAS

– **Scoggins, M. T.**, Haiman, Z., & Paucci, F, 2025, Assessing the likelihood of Leo I hosting a Heavy Seed Black Hole, (in prep)

– **Scoggins, M. T.**, & Kipping, D., 2025, Lazarus Stars: A method for detecting engineered stars in the Milky Way, (in prep)

9 Onoue, M., Ding, X., Silverman, J., Matsuoka, Y., et al. (including **Scoggins, M. T.**, 2024, A Post-Starburst Pathway to Forming Massive Galaxies and Their Black Holes at z>6, arXiv:2409.07113

8 **Scoggins, M. T.**, & Haiman, Z., 2024, Diagnosing the Massive-Seed Pathway to High-Redshift Black Holes: Statistics of the Evolving Black Hole to Host Galaxy Mass Ratio, MNRAS, **531**, 4584

51 Li, J., Silverman, J., Shen, Y., Volonteri, M., et al. (including **Scoggins, M. T.**, 2024, Tip of the Iceberg: Overmassive Black Holes at 4<z<7 Found by JWST Are Not Inconsistent With the Local $\{M\}_{\mathrm{BH}}$-$\{M\}_{\star}$ Relation, arXiv:2403.00074

2 **Scoggins, M. T.**, & Kipping, D., 2023, Lazarus Stars: Numerical Investigations of Stellar Evolution With Star-Lifting as a

Life Extension Strategy, MNRAS, **523**, 3251

– Roser, P., & **Scoggins, M. T.**, 2023, Non-Quantum Behaviors of Configuration-Space Density Formulations of Quantum Mechanics, arXiv:2303.04959

18 **Scoggins, M. T.**, Haiman, Z., & Wise, J., 2023, How Long Do High Redshift Massive Black Hole Seeds Remain Outliers in Black Hole Versus Host Galaxy Relations?, MNRAS, **519**, 2155

– **Scoggins, M. T.**, & Rahmani, A., 2021, Topological and Geometric Patterns in Optimal Bang-Bang Protocols for Variational Quantum Algorithms: Application to the X X Z Model on the Square Lattice, Physical Review Research, **3**, 43165

42 Olney, R., Kounkel, M., Schillinger, C., **Scoggins, M. T.**, et al., 2020, APOGEE Net: Improving the Derived Spectral Parameters for Young Stars Through Deep Learning, AJ, **159**, 182

8 **Scoggins, M. T.**, Davenport, J., & Covey, K., 2019, Using Flare Rates to Search for Stellar Activity Cycles, Research Notes of the American Astronomical Society, **3**, 137