Dr. Tim B. Miller

CIERA
Northwestern University
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Citizenship: Canada

Research Interests

Galaxy Evolution; Galaxy morphology; Bayesian Modeling; Machine learning

Education & Experience

Postdoctoral Fellow — Fall 2023-Present
Northwestern University, IL, USA
Center for Interdisciplinary Exploration and Research in Astrophysics (CIERA)

Ph.D, Astronomy — Awarded July 2023
Yale University, CT, USA
Supervisor: Pieter van Dokkum
Thesis: A New View of Galaxy Morphology

Masters of Science, Physics — Awarded August 2017
Dalhousie University, Nova Scotia, Canada
Supervisor: Scott Chapman
Thesis: *Star Formation Rate Indicators in the FIRE Simulations & SPT2349-56: A Massive and Active Proto-cluster*

Visiting Researcher — 2015-2016
California Institute of Technology
Supervisors: Phil Hopkins and Chris Hayward

Bachelor of Science, First Class Honors in Physics — Awarded May 2015
Dalhousie University, Nova Scotia, Canada

Scholarships & Awards

CIERA Postdoctoral Fellowship — 2023 - 2026
· Independent Fellow

Gruber Science Fellowship — 2017 - 2020
· Award to highly ranked Ph.D applicants

Killam Predoctoral Scholarship — 2015 - 2017
· University wide scholarship for M.Sc program

NSERC Canada Graduate Scholarship — 2016
· Federal scholarship comparable to NSF GRFP

Nova Scotia Graduate Scholarship — 2016 - 2017
· Provincial wide scholarship for M.Sc program

Conferences & Seminars

CIERA Fellows at 15 - Northwestern University	August, 2025
CHOIR conference - Schoodic Institute	July, 2025
Astrophysics Seminar - Geneva Observatory	May, 2025
Astrophysics Seminar - Notre Dame University	March, 2025
High-z Galaxy Workshop - U. Chicago, KICP	February, 2025
Dwarf Galaxies in the LSST Era - U. Chicago, KICP	July, 2024
Rare Gems in Big Data - NOIRLab	May 2024

Extragalactic Seminar - Arizona State University	Jun. 2023
Early results from the JWST - Cambridge	Mar. 2023
AAS 241 - Dissertation Talk	Jan. 2023
First Results from JWST - STScI	Dec. 2022
Tea Talk - Caltech	Oct. 2022
Galaxies and AGN journal club - John Hopkins U.	Feb. 2022
Local "Local Group" Group - Flatiron Institute	Nov. 2021
Thunch - Princeton	Sept. 2021
EAS Annual Meeting	July 2021
AAS 235 - Dragonfly Telephoto Array Special Session	Jan 2020

Open Source Software

Co-Lead Developer - `pysersic`
· Fully Bayesian Sersic Profile fitting implemented in `jax`
Lead Developer - `imcascade`
· Flexible method for measuring galaxy morphology based on Mixture of Gaussians
Contributions
- `sbi`
· Added flexibility to memory management, helpful for training large datasets on GPUs
- `ArtPop`
· Algorithmic improvements to speed up simulations by $> 4\times$

Observational Experience

JWST - NIRCam
· Extensive Experience with NIRcam imaging data
· Funded Co-I: GO-07814 - Cycle 4 - 260 Hours - $41k awarded
HST -
· Extensive experience working with ACS and WFC3 data
· PI: GO-17714 - Cycle 32 - 11 orbits - $75k awarded
Keck I - LRIS — Apr. 2021
· 2 nights observing
Dragonfly Telephoto Array — 2020 - 2022
· Recurring remote observer
Keck I - MOSFIRE — Nov. 2018
· 3 nights observing
Sub-millimetre Array — July 2016
· Guest observer for 5 nights

Community & Service

Scientific Organizing Committee – CIERA Fellows at 15 — Aug. 2025
Journal Referee — 2022 - Present
· AAS Journals, JOSS, A&A
TAC Reviewer
· CFHT, Yale Internal
Yale Astronomy Student Council – Founding Member — Fall 2018 - Fall 2021
· Worked with students to communicate concerns to faculty and improve program
Journal club and Speaker Series' Organizer:
- CIERA – Observer Group meeting — Fall 2024 - Present
- Yale - Astronomy × Data Science Journal Club — Fall 2021 - Spring 2023
- Yale - Galaxy Lunch — Fall 2019 - Fall 2021

Outreach

Astronomy Conversations – Adler Planetarium — Summer 2024 - Present
· Open discussions with the public on Astronomy and Science in general
Astronomy on tap New Haven – Public Talk — July 2019
· "The Hubble constant and our expanding universe"

Physics Fun and Discovery Days – Presenter Summers 2013-2016
· Performed physics demonstrations to elementary and junior high school students

Mentoring

REU Mentor - Madeline Evenson
· Undergraduate at U. Kansas
· Poster Presentation at AAS 247
Co-mentor - Yunchong Zhang
· Graduate Student at U.Pitt
· First author publication to be submitted by end of 2025

Publications

13 First Author, 53 Co-Authored, ads library, ORCID: 0000-0001-8367-6265,

First Authored

Miller, T. B.. & Pasha, I. 2025, "Using Symbolic Regression to Emulate the Radial Fourier Transform of the Sérsic Profile for Fast, Accurate and Differentiable Galaxy Profile Fitting" , arXiv:2508.20266, OJA, In Review

Miller, T. B., Suess, K. A., Setton, D. J., et al. 2025 "JWST UNCOVERs the Optical Size - Stellar Mass Relation at $4 < z < 8$: Rapid Growth in the Sizes of Low Mass Galaxies in the First Billion Years of the Universe", ApJ, Volume 988, Issue 2, id.196, 25 pp

Miller, T. B., Pasha, I., Polzin, A., et al. 2025, "Silkscreen: Direct Measurements of Galaxy Distances from Survey Image Cutouts" ApJ, Volume 170, Issue 2, id.102, 25 pp.

Pasha, I. & **Miller, T. B.** (Co-lead authors), 2023."pysersic: A Python package for determining galaxy structural properties via Bayesian inference, accelerated with jax". JOSS, 8(89), 5703

Miller, T. B., van Dokkum, P., & Mowla, L. 2023, "Color gradients and half-mass radii of galaxies out to $z = 2$ in the CANDELS/3D-HST fields: further evidence for important differences in the evolution of mass-weighted and light-weighted sizes" , ApJ, 945, 2, 155

Miller, T. B., Whitaker, K. E., Nelson, E. J., et al. 2022, "Early JWST imaging reveals strong optical and NIR color gradients in galaxies at $z \sim 2$ driven mostly by dust", ApJL, 941, 2, L37

Miller, T. B. & van Dokkum, P., 2021, "Bayesian fitting of multi-Gaussian expansion models to galaxy images", ApJ, 923, 1, 124

Miller, T. B., van Dokkum, P., Danieli, S., et al. 2021, "The Dragonfly Wide Field Survey. II. Accurate Total Luminosities and Colors of Nearby Massive Galaxies and Implications for the Galaxy Stellar Mass Function", ApJ, 909, 74

Miller, T. B., van den Bosch, F. C., Green, S. B., et al. 2020, "Dynamical self-friction: how mass loss slows you down ", MNRAS , 495, 4496.

Miller, T. B., Chapman, S., Hayward, C. C., et al., 2020, "Investigating overdensities around $z > 6$ Galaxies through ALMA observations of [CII]", ApJ , 889, 2

Miller, T. B., van Dokkum, P., Mowla, L. and van der Wel, A. 2019, "A New View of the Size-Mass Distribution of Galaxies: Using r_{20} and r_{80} Instead of r_{50}", ApJL, 872, L14

Miller, T. B., Chapman, S. C., Aravena, M., et al., 2018, "A massive core for a cluster of galaxies at a redshift of 4.3" , Nature, 556, 469

Miller, T. B., Hayward, C. C., Chapman, S. C., et al. 2015, "The bias of the submillime-

tre galaxy population: SMGs are poor tracers of the most-massive structures in the z∼2 Universe", MNRAS, 452, 878

Significant Contribution
† **- Student Lead**

Wang, B., de Graaff, A., ... **Miller, T. B.** ..., et al. 2025,"RUBIES: JWST/NIRSpec Confirmation of an Infrared-luminous, Broad-line Little Red Dot with an Ionized Outflow", ApJ, 984, 2, 121.

† Korhonen Cuestas, N. A., Strom, A. L., **Miller, T. B.** , et al. 2025, "Exploring the Relationship between Stellar Mass, Metallicity, and Star Formation Rate at z $\sim$ 2.3 in KBSS-MOSFIRE" , ApJ, 984, 2, 188.

Hviding, R. E., de Graaff, A.,**Miller, T. B.** , et al. 2025, " RUBIES: A Spectroscopic Census of Little Red Dots; All V-Shaped Point Sources Have Broad Lines", arXiv:2506.05459. Accepted, A& A

Labbe, I., Greene, J.,... **Miller, T. B.** ..., et al. 2024, "An unambiguous AGN and a Balmer break in an Ultraluminous Little Red Dot at z=4.47 from Ultradeep UNCOVER and All the Little Things Spectroscopy", ApJ submitted, arXiv:2412.04557.

† Treiber, H., Greene, J.,... **Miller, T. B.** ... , et al. 2025,"UNCOVERing the High-Redshift AGN Population Among Extreme UV Line Emitters" , ApJ, Volume 984, Issue 1, id.93, 25 pp.

† Benton, C. E., Nelson, E. J., **Miller, T. B.**, et al. 2024, "JWST Reveals Bulge-Dominated Star-forming Galaxies at Cosmic Noon", arXiv:2409.08328., Accepted ApJ

† Weibel, A., de Graaff, A.,... **Miller, T. B.** ... , et al. 2024," RUBIES Reveals a Massive Quiescent Galaxy at $z = 7.3$", arXiv:2409.03829, ApJL Submitted

Setton, D. J., Khullar, G., **Miller, T. B.**, et al. 2024,"UNCOVER NIRSpec/PRISM Spectroscopy Unveils Evidence of Early Core Formation in a Massive, Centrally Dusty Quiescent Galaxy at $z_{\rm spec} = 3.97$ " , ApJ, 974, 145.

Wang, B., Fujimoto, S., ... **Miller, T. B.** ... , et al. 2023,"UNCOVER: Illuminating the Early Universe – JWST/NIRSpec Confirmation of $z > 12$ Galaxies", ApJL, 957, L34

Mowla, L., van der Wel, A., van Dokkum, P. and **Miller, T. B.**, "A Mass-dependent Slope of the Galaxy Size-Mass Relation out to $z \sim 3$: Further Evidence for a Direct Relation between Median Galaxy Size and Median Halo Mass", 2019, ApJLn, 872, L13

Co-authored

Rogers, N. S. J., Strom, A. L.,... **Miller, T. B.** ... , et al. 2025, "CECILIA: Gas-Phase Physical Conditions and Multi-Element Chemistry at Cosmic Noon", arXiv:2509.18257., ApJL, Submitted

Zhang, Y., de Graaff, A.,... **Miller, T. B.** ... , et al. 2025,"RUBIES spectroscopically confirms the high number density of quiescent galaxies from $2 < z < 5$" , arXiv:2508.08577, ApJ, Submitted

Muzzin, A., Suess, K. A., ... **Miller, T. B.** ... , et al. 2025, "MINERVA: A NIRCam Medium Band and MIRI Imaging Survey to Unlock the Hidden Gems of the Distant Universe" , arXiv:2507.19706, ApJS Submitted

Setton, D. J., Greene, J. E., ... **Miller, T. B.** ... , et al. 2025, "A confirmed deficit of hot and cold dust emission in the most luminous Little Red Dots", arXiv:2503.02059. ApJ, Accepted

de Graaff, A., Rix, H.-W., ... **Miller, T. B.** ... , et al. 2025, "A remarkable Ruby:

Absorption in dense gas, rather than evolved stars, drives the extreme Balmer break of a Little Red Dot at z=3.5" , arXiv:2503.16600. A&A, Accepted

Pan, R., Suess, K. A., ... **Miller, T. B.** ... , et al. 2025,"UNCOVER/MegaScience: No Evidence of Environmental Quenching in a z $\sim$ 2.6 Proto-cluster", arXiv:2504.06334. ApJ, Accepted

Cutler, S. E., Weaver, J. R.,... **Miller, T. B.** ... , et al. 2025, "The Structure and Formation Histories of Low-Mass Quiescent Galaxies in the Abell 2744 Cluster Environment", ApJ, In Review, arXiv:2504.10572.

Lorenz, B., Suess, K. A., ... **Miller, T. B.** ... , et al. 2025, "Measuring Emission Lines with JWST MegaScience Medium Bands: A New Window into Dust and Star Formation at Cosmic Noon", ApJL, 988, 1, L20.

Mintz, A., Setton, D. J., ... **Miller, T. B.** ... et al. 2025, " Taking a Break at Cosmic Noon: Continuum-selected Low-mass Galaxies Require Long Burst Cycles", arXiv:2506.16510, submitted to ApJ

Fujimoto, S., Wang, B., ... **Miller, T. B.** ... et al. 2024,"UNCOVER: A NIRSpec Census of Lensed Galaxies at $z = 8.50 - 13.08$ Probing a High AGN Fraction and Ionized Bubbles in the Shadow", ApJ, Volume 977, Issue 2, id.250, 21 pp.

Setton, D. J., Greene, J. E., ... **Miller, T. B.** ... , et al. 2024, "Little Red Dots at an Inflection Point: Ubiquitous "V-Shaped" Turnover Consistently Occurs at the Balmer Limit" Submitted to ApJ, arXiv:2411.03424

Siegel, J., Setton, D., Greene, J.,... **Miller, T. B.** ... et al. 2024, "UNCOVER: Significant Reddening in Cosmic Noon Quiescent Galaxies", ApJ, submitted, arXiv:2409.11457.

de Graaff, A., Brammer, G.,... **Miller, T. B.** ... et al. 2024, "RUBIES: a complete census of the bright and red distant Universe with JWST/NIRSpec", A&A Submitted, arXiv:2409.05948,

Price, S. H., Bezanson, R., Labbe, I., ... **Miller, T. B.** ... et al. 2024, "The UNCOVER Survey: First Release of Ultradeep JWST/NIRSpec PRISM spectra for 700 galaxies from z 0.3-13 in Abell 2744 ", ApJ Submitted , arXiv:2408.03920

Clausen, M., Whitaker, K. E., ... **Miller, T. B.** ... et al. 2024, " 3D-DASH: The Evolution of Size, Shape, and Intrinsic Scatter in Populations of Young and Old Quiescent Galaxies at $0.5 < z < 3$", ApJ, 971, 99.

Cramer, W. J., Noble, A. G., ... **Miller, T. B.** ... et al. 2024, "Resolved UV and optical color gradients reveal environmental influence on galaxy evolution at redshift z $\sim$ 1.6" ApJ, Accepted, arXiv:2404.07355.

Suess, K. A., Weaver, J. R., Price, S. H., ... **Miller, T. B.** ... et al. 2024, "Medium Bands, Mega Science: a JWST/NIRCam Medium-Band Imaging Survey of Abell 2744", arXiv:2404.13132, ApJ Submitted

Kokorev, V., Caputi, K. I., Greene, J. E.,... **Miller, T. B.** ... et al. 2024, "A Census of Photometrically Selected Little Red Dots at $4 < z < 9$ in JWST Blank Fields" ApJ, 968, 38.

Cutler, S. E., Whitaker, K. E., .. **Miller, T. B.** ... , et al. 2024, "Two Distinct Classes of Quiescent Galaxies at Cosmic Noon Revealed by JWST PRIMER and UNCOVER ", ApJL, 967, L23

Wright, L., Whitaker, K. E., .. **Miller, T. B.** ... , et al. 2024,"Remarkably Compact Quiescent Candidates at $3 < z < 5$ in JWST-CEERS ", ApJL, 964, L10.

Furtak, L. J., Labbé, I., ... **Miller, T. B.** ... , et al. 2024, "A high black-hole-to-host mass ratio in a lensed AGN in the early Universe", Nature, 628, 57.

van der Wel, A., Martorano, M., ... **Miller, T. B.** ... et al. 2024,Stellar Half-Mass Radii of $0.5 < z < 2.3$ Galaxies: Comparison with JWST/NIRCam Half-Light Radii, ApJ, 960, 53

Price, S. H., Suess, K. A., .. **Miller, T. B.** ... , et al. 2023, "UNCOVER: The rest ultraviolet to near infrared multiwavelength structures and dust distributions of sub-millimeter-detected galaxies in Abell 2744", arXiv:2310.02500. Submitted to ApJ

Kokorev, V., Fujimoto, S., .. **Miller, T. B.** ... , et al. 2023, "UNCOVER: A NIRSpec Identification of a Broad-line AGN at z = 8.50", ApJL, 957, L7.

Martorano, M., van der Wel, A., .. **Miller, T. B.** ... et al. 2023," Rest-frame Near-infrared Radial Light Profiles up to $z = 3$ from JWST/NIRCam: Wavelength Dependence of the Sérsic Index" ApJ, 957, 46.

Fujimoto, S., Bezanson, R.,... **Miller, T. B.** ... et al. 2023," DUALZ: Deep UNCOVER-ALMA Legacy High-Z Survey", arXiv:2309.07834. Submitted to ApJS

Greene, J. E., Labbe, I., ... **Miller, T. B.** ... et al. 2023, "UNCOVER spectroscopy confirms a surprising ubiquity of AGN in red galaxies at $z > 5$" arXiv:2309.05714 , ApJ, 964, 39.

Goulding, A. D., Greene, J. E., ... **Miller, T. B.** ... et al. 2023, "UNCOVER: The Growth of the First Massive Black Holes from JWST/NIRSpec-Spectroscopic Redshift Confirmation of an X-Ray Luminous AGN at $z = 10.1$", ApJL, 955, L24.

Baggen, J. F. W., van Dokkum, P., ... **Miller, T. B.** ... et al. 2023, "Sizes and Mass Profiles of Candidate Massive Galaxies Discovered by JWST at $7 < z < 9$: Evidence for Very Early Formation of the Central 100 pc of Present-day Ellipticals", ApJL, 955, L12.

Nelson, E. J., Suess, K. A., ... **Miller, T. B.** ... et al. 2023,"JWST reveals a population of ultra-red, flattened disk galaxies at $2 < z < 6$ previously missed by HST", ApJL, 948, L18

Suess, K. A., Bezanson, R.,... **Miller, T. B.** ..., et al. 2022, "Rest-frame near-infrared sizes of galaxies at cosmic noon: objects in JWST's mirror are smaller than they appeared ", ApJL, 937, L33

Lokhorst, D., Abraham, R.,,... **Miller, T. B.** ..., et al. 2022, "A Giant Shell of Ionized Gas Discovered near M82 with the Dragonfly Spectral Line Mapper Pathfinder", ApJ, 927, 136.

Pasha, I., Lokhorst, D.,... **Miller, T. B.** ..., et al. 2021, "A Nascent Tidal Dwarf Galaxy Forming within the Northern H I Streamer of M82", ApJL 923

Liu, Q., Abraham, R., ... **Miller, T. B.** ..., et al. 2021, "A Method To Characterize the Wide-Angle Point Spread Function of Astronomical Images", ApJ, 925, 219

Keim, M. A., van Dokkum, P., ... **Miller, T. B.** ... , et al. 2021, "Tidal Distortions in NGC1052-DF2 and NGC1052-DF4: Independent Evidence for a Lack of Dark Matter ", ApJ, 935, 160

Hill, R., Chapman, S. C., ... **Miller, T. B.** ... , et al. 2021,"A census of the stellar content in the protocluster core SPT2349−56 at $z = 4.3$", submitted to MNRAS, arXiv:2109.04534

Cunningham, D. J. M., Chapman, S. C. .... **Miller, T. B.** ... , et al. 2020, The [C II]/[N II] ratio in $3 < z < 6$ sub-millimetre galaxies from the South Pole Telescope survey MNRAS, 494, 4090

Danieli, S., Lokhorst, D., ... **Miller, T. B.** ... , et al. 2020, "The Dragonfly Wide Field Survey. I. Telescope, Survey Design and Data Characterization", ApJ , 894, 119

Ogiya, G., van den Bosch, F. C., ... **Miller, T. B.** ... et al. 2019, "DASH: a library of dynamical subhalo evolution ", MNRAS, 485, 189.

Marrone, D. P., Spilker, J. S., ... **Miller, T. B.** ... , et al. "Galaxy growth in a massive halo in the first billion years of cosmic history", Nature, 2018, 553, 51

Strandet, M. L., Weiss, A., ... **Miller, T. B.** ... , et al. , "ISM Properties of a Massive Dusty Star-forming Galaxy Discovered at z $\sim$ 7", ApJL, 2017, 842, L15

Orr, M. E., Hayward, C. C., ... **Miller, T. B.** ... , et al. "Stacked Star Formation Rate Profiles of Bursty Galaxies Exhibit "Coherent" Star Formation", ApJL , 2017, 849, L2