

Patrick C. Breysse

Assistant Professor of Physics, Southern Methodist University
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PROFESSIONAL HISTORY	Southern Methodist University, Department of Physics Dallas, TX, USA Assistant Professor of Physics	Aug 2024-Present
	NYU Center for Cosmology and Particle Physics New York University, New York, NY, USA James Arthur Postdoctoral Fellow	Sep 2020-202407
	Canadian Institute for Theoretical Astrophysics University of Toronto, Toronto, ON, Canada CITA Postdoctoral Fellow	Sep 2017- Aug 2020
EDUCATION	Johns Hopkins University , Baltimore, MD, USA Doctor of Philosophy (Ph.D.) in Physics and Astronomy • Adviser: Professor Marc Kamionkowski • Research areas: Theoretical cosmology, large scale structure, intensity mapping • Thesis: High-Redshift Astrophysics and Cosmology with Intensity Mapping	Jun 2012 – May 2017
	Master of Arts (M.A.) in Physics and Astronomy	Jun 2012 – May 2015
	The Pennsylvania State University , University Park, Pennsylvania, USA Bachelor of Science (B.S.) in Physics Bachelor of Science (B.S.) in Astronomy and Astrophysics • Graduated with Distinction and with Honors in Physics.	Aug 2008 – May 2012
COLLABORATION MEMBERSHIPS	Carbon Monoxide Mapping Array Pathfinder (COMAP) Lead, Science & Modeling Working Group	2018 – Present
	Fred Young Submillimeter Telescope (FYST) (formerly CCAT-prime) Member, Science Working Group	2018 – Present
	EXperiment for Cryogenic Large-Aperture Intensity Mapping (EXCLAIM) Member, Science Working Group	2019 – Present
STUDENTS MENTORED	Clara Chung Former Univ. of Toronto undergraduate (now Ph.D. student at Cornell Univ.)	
	Henry Liu Former UBC undergraduate (now Ph.D. student at UC Berkeley)	
	Anubhav Mathur former Univ. of Toronto undergraduate (now Ph.D. student at Johns Hopkins Univ.)	
TEACHING	Galactic Astrophysics SMU PHYS 4372/6372	Spring 2025
	Summer Astro 101 Course Lecturer	Summer 2018, 2019, 2020
	General Physics I, JHU Teaching Assistant	Spring 2014

**PUBLICATIONS
AND PREPRINTS**

Papers led or co-led (* = Submitted, ** = In preparation)

- 1) P. C. Breyse, D. T. Chung, H. T. Ihle, “Characteristic functions for cosmological cross-correlations”, *MNRAS*, 525, 1824 (2023), [arXiv:2210.14902]
- 2) P. C. Breyse et al., “COMAP Early Science Results: VII. Prospects for CO Intensity Mapping at Reionization”, *ApJ*, 933, 188 (2022), **ApJ Focus Issue** [arXiv:2111.05933]
- 3) P. C. Breyse, S. Yang, R. S. Somerville, A. R. Pullen, G. Popping, A. S. Maniyar, “On estimating the cosmic molecular gas density from CO Line Intensity Mapping observations”, *ApJ*, 929, 30 (2022) [arXiv:2106.14904]
- 4) P. C. Breyse, S. Foreman, L. C. Keating, J. Meyers, N. Murray, “Mapping the Universe in HD”, *PRD*, 105, 8 (2022), **Editor’s Suggestion, Featured in Physics** [arXiv:2104.06422]
- 5) P. C. Breyse, C. J. Anderson, and P. Berger, “Canceling Out Intensity Mapping Foregrounds”, *PRL*, 123, 23 (2019) [arXiv:1907.04369]
- 6) P. C. Breyse and R. M. Alexandroff, “Observing AGN feedback with CO intensity mapping”, *MNRAS*, 490, 260, (2019) [arXiv:1904.03197]
- 7) P. C. Breyse, Y. Ali-Haïmoud, C. M. Hirata, “The Ultimate Frontier of 21 cm Cosmology”, *PRD*, 98, 043520, (2018), [arXiv:1804.10626]
- 8) P. C. Breyse, E. D. Kovetz, P. S. Behroozi, L. Dai, and M. Kamionkowski, “Insights From Probability Distribution Functions of Intensity Maps”, *MNRAS*, 467, 2996, (2017) [arXiv:1609.01728]
- 9) P. C. Breyse, M. Rahman, “Feeding cosmic star formation: Exploring high-redshift molecular gas with CO intensity mapping”, *MNRAS*, 468, 741, (2017) [arXiv:1606.07820]
- 10) P. C. Breyse, E. D. Kovetz, and M. Kamionkowski, “The High Redshift Star-Formation History From Carbon Monoxide Intensity Maps”, *MNRAS Letters*, 457, L127, (2016) [arXiv:1507.06304]
- 11) P. C. Breyse, E. D. Kovetz, and M. Kamionkowski, “Masking Line Foregrounds in Intensity Mapping Surveys”, *MNRAS*, 452, 3408, (2015) [arXiv:1503.05202]
- 12) P. C. Breyse, E. D. Kovetz, and M. Kamionkowski, “Carbon Monoxide Intensity Mapping at Moderate Redshifts”, *MNRAS*, 443, 3506, (2014) [arXiv:1405.0489]
- 13) P. C. Breyse, M. Kamionkowski, and A. Benson, “Oscillations and Stability of Polytropic Filaments”, *MNRAS*, 437, 2675, (2014) [arXiv:1305.2198]

Collaboration papers with significant contribution

- 14) D. T. Chung, P. C. Breyse, K. A. Cleary et al., “COMAP Pathfinder - Season 2 results III: Implications for cosmic molecular gas content at $z \sim 3$ ”, *A&A*, 691, A337 (2024) [arXiv:2406.07512]
- 15) N. O. Stutzer, J. G. S. Lunde, P. C. Breyse et al., “COMAP Pathfinder - Season 2 results II: Updated constraints on the CO(1-0) Power Spectrum”, *A&A*, 691, A336 (2024) [arXiv:2406.07511]
- 16) J. G. S. Lunde, N. O. Stutzer, P. C. Breyse et al., “COMAP Pathfinder - Season 2 results I: Improved data selection and processing” *A&A*, 691, A335 (2024) [arXiv:2406.07510]

- 17) D. T. Chung, J. Chluba, P. C. Breysse, “Carbon monoxide and ionized carbon line emission global signals: foregrounds and targets for absolute microwave spectrometry”, *PRD*, 110, 2 (2024) [arXiv:2311.03297]
- 18) D. A. Dunne, K. A. Cleary, P. C. Breysse et al., “COMAP Early Science: VIII. A Joint Stacking Analysis with eBOSS Quasars”, *ApJ* 965 7 (2024) [arXiv:2304.09832]
- 19) Zhang, Yucheng, A. R. Pullen, R. S. Somerville, P. C. Breysse et al., “Characterizing the Conditional Galaxy Property Distribution using Gaussian Mixture Models”, *ApJ*, 950, 159 [arXiv:2302.11166]
- 20) D. T. Chung, I. Bangari, P. C. Breysse et al., “The deconvolved distribution estimator: enhancing reionisation-era CO line-intensity mapping analyses with a cross-correlation analogue for one-point statistics”, *MNRAS*, 520, 5305 (2023) [arXiv:2212.14890]
- 21) A. R. Pullen, P. C. Breysse et al., “Extragalactic Science with the Experiment for Cryogenic Large-Aperture Intensity Mapping”, *MNRAS*, 521, 6124 (2023) [arXiv:2209.02497]
- 22) H. Padmanabhan, P. C. Breysse, A. Lidz, and E. R. Switzer, “Intensity mapping from the sky: synergizing the joint potential of [OIII] and [CII] surveys at reionization”, *MNRAS*, 515, 5813 (2022) [arXiv:2105.12148]
- 23) C. J. Anderson, E. R. Switzer, P. C. Breysse, “Constraining low redshift [CII] emission by cross-correlating FIRAS and BOSS data”, *MNRAS*, 514, 1169 (2022) [arXiv:2202.00203]
- 24) K. Cleary, J. Borowska, P. C. Breysse et al., “COMAP Early Science: I. Overview”, *ApJ*, 933, 182 (2022) **ApJ Focus Issue** [arXiv:2111.05927]
- 25) D. Chung, P. C. Breysse et al., “COMAP Early Science: V. Constraints and Forecasts at $z \sim 3$ ”, *ApJ*, 933, 188 (2022) **ApJ Focus Issue** [arXiv:2111.05931]
- 26) S. Yang, G. Popping, R. S. Somerville, A. R. Pullen, P. C. Breysse, A. S. Maniyar, “An empirical representation of a physical model for the ISM [CII], CO, and [CI] emission at redshift $1 \leq z \leq 9$ ”, *ApJ*, 929, 140 (2022) [arXiv:2108.07716]
- 27) *CCAT-Prime Collaboration (inc. P. C. Breysse) “Science Goals and Forecasts with Prime-Cam on the Fred Young Submillimeter Telescope”, submitted to *ApJ* [arXiv:2107.10364]
- 28) D. T. Chung, P. C. Breysse, H. T. Ihle et al., “A model of spectral line broadening in signal forecasts for line-intensity mapping experiments”, *ApJ*, 923, 188 (2021) [arXiv:2104.11171]
- 29) S. Yang, R. S. Somerville, A. R. Pullen, G. Popping, P. C. Breysse, A. S. Maniyar, “Multitracer cosmological line intensity mapping mock lightcone simulation”, *ApJ*, 911, 132, (2021), [arXiv:2009.11933]
- 30) H. Liu and P. C. Breysse, “Coupling parsec and gigaparsec scales: primordial non-Gaussianity with multi-tracer intensity mapping”, *PRD*, 103, 6 (2021) [arXiv:2002.10483]
- 31) J. L. Bernal, P. C. Breysse, and E. D. Kovetz, “The Cosmic Expansion History from Line-Intensity Mapping”, *PRL*, 123, 25, (2019), [arXiv:1907.10065]
- 32) J. L. Bernal, P. C. Breysse, H. Gil-Marín, and E. D. Kovetz, “A User’s Guide to Extracting Cosmological Information from Line-Intensity Maps”, *PRD*, 100, 12, (2019), [arXiv:1907.10067]
- 33) *D. N. Pfeffer, P. C. Breysse, and G. Stein, “Deconfusing Intensity Maps with Neural Networks”, (2019) [arXiv:1905.10376]
- 34) *D. Li, A. Yalinewich, and P. C. Breysse, “Statistical Inference of the Distance to ASKAP FRBs”, (2019) [arXiv:1902.10120]
- 35) *E. D. Kovetz et al. (inc. P. C. Breysse), “Line Intensity Mapping: 2017 Status Report”, submitted to *Physics Reports*, (2017), [arXiv:1709.09066]

- 36) E. D. Kovetz, I. Cholis, P. C. Breysse, and M. Kamionkowski, “The Black Hole Mass Function from Gravitational Wave Measurements”, *PRD*, 95, 103010, (2017) [arXiv:1611.01157]

Collaboration papers with some contribution

- 37) S. Dahal et al. (inc. P. C. Breysse), “Superfluid-tight cryogenic receiver with continuous sub-Kelvin cooling for EXCLAIM”, *Proceedings of the SPIE*, 1310221 (2024) [arXiv:2409.02847]
- 38) J. Lamb et al. (inc. P. C. Breysse), “COMAP Early Science: II. Pathfinder Instrument”, *ApJ*, 933, 183 (2022), **ApJ Focus Issue** [arXiv:2111.05928]
- 39) M. K. Foss et al. (inc. P. C. Breysse), “COMAP Early Science: III. CO Data Processing”, *ApJ*, 933, 184 (2022), **ApJ Focus Issue** [arXiv:2111.05929]
- 40) H. T. Ihle et al. (inc. P. C. Breysse), “COMAP Early Science: IV. Power Spectrum Methodology and Results”, *ApJ*, 933, 185 (2022) , **ApJ Focus Issue**[arXiv:2111.05930]
- 41) T. J. Rennie et al. (inc. P. C. Breysse), “COMAP Early Science: A First Look at the COMAP Galactic Plane Survey”, *ApJ*, 933, 186 (2022), **ApJ Focus Issue** [arXiv:2111.05932]
- 42) G. Cataldo et al. (inc. P. C. Breysse), “Overview and status of EXCLAIM, the experiment for cryogenic large-aperture intensity mapping”, *SPIE Proceedings* 114530H (2020) [arXiv:2101.11734]
- 43) P. R. Ade et al. (inc. P. C. Breysse) ”The Experiment for Cryogenic Large-Aperture Intensity Mapping (EXCLAIM)”, *Journal of Low Temperature Physics*, 199, 3-4 (2020) [arXiv:1912.07118]
- 44) D. T. Chung et al. (inc. P. C. Breysse), “Cross-correlating Carbon Monoxide Line-intensity Maps with Spectroscopic and Photometric Galaxy Surveys”, *ApJ*, 872, 186, (2019) [arXiv:1809.04550]
- 45) H. T. Ihle et al. (inc. P. C. Breysse), “Joint power spectrum and voxel intensity distribution forecast on the CO luminosity function with COMAP”, *ApJ*, 871, 1, (2019) [arXiv:1808.07487]
- 46) Stacey, G. J. et. al, (inc. Patrick C. Breysse), “CCAT-prime: Science with an Ultra-widefield Submillimeter Observatory at Cerro Chajnantor”, *Proc. SPIE* 10700:107001M, (2018) [arXiv:1807.04354]

White papers led or with significant contribution

- 47) K. S. Karkare, A. Moradinezhad-Dizgah, G. K. Keating, P. C. Breysse, D. T. Chung, ”Snowmass 2021 Cosmic Frontier White Paper: Cosmology with Millimeter-Wave Line Intensity Mapping”, Contribution to Snowmass 2021 (2022) [arXiv:2203.07258]
- 48) M. B. Silva et al. (inc. P. C. Breysse), ”Mapping Large-Scale-Structure Evolution Over Cosmic Times”, ESA Voyage-2050 White Paper [arXiv:1908.07533]
- 49) P. C. Breysse et al. ”Astrophysics and Cosmology with Line Intensity Mapping” Canadian Long Range Plan for Astronomy and Astrophysics White Paper, id.38 (2019)
- 50) E. D. Kovetz, P. C. Breysse, A. Lidz et al., “Astrophysics and Cosmology with Line Intensity Mapping”, Astro2020 Decadal White Paper (2019) [arXiv:1903.04496]

**PROFESSIONAL
SERVICE**

CCPP Astrophysics Seminar
Organizer

2020, 2023-Present

CCPP Astro-ph Journal Club
Organizer

2022-2023

	NYU Physics Department Equity and Inclusion Committee Member	2021-2022
	CCA Tri-State Cosmology x Data Science Meeting Organizer	2021-2022
	Univ. of Toronto Summer Undergraduate Research Program Committee Chair	2020
	Member	2019
	CITA Cosmology Discussion Group Organizer	2019–2020
	CITA Research Jamboree Organizer	2018,2019
	2nd Annual Intensity Mapping Workshop, JHU Local Organizing Committee	2016
	Professional Society Memberships American Astronomical Society, American Physical Society	
SELECTED AWARDS	Participant, 66th Lindau Nobel Laureate Meeting,	Jun 2016
	Max Bodmer Graduate Research Fellowship,	Sep 2012
	Penn State Astronomy and Astrophysics Student Marshall,	May 2012
OUTREACH	Solar Eclipse Viewing at SMU Telescope viewing	Apr 2024
	St. Andrews Toronto Heart of the City Speaker Series Speaker	Jan 2024
	Cosmic Happy Hour Public Lecture Speaker	Nov 2023
	MSI/AstroMcGill Public Lecture Speaker	Jul 2022
	Cosmos from your Couch Speaker	2020
	University of Toronto AstroTours Speaker, Telescope Operator	Aug 2019
	Toronto Planet Gazing Party Telescope Operator	2018,2019
	Astronomy on Tap TO, Toronto ON Speaker	Aug 2018
	Physics and Astronomy Graduate Students Outreach, Johns Hopkins University Member, Executive Board WorldWide Telescope Coordinator	Sep 2013 – Aug 2017
	Johns Hopkins Physics Fair Sound and Music Demo Room, PAGS Outreach Planetarium,	Apr 2013 Apr 2014, Apr 2015, Apr 2017

STEM Achievement in Baltimore Elementary Schools

Fall Showcase

Dec 2014

Spring Showcase

May 2016

**SELECTED
PRESENTATIONS****Invited Talks**

KICP Seminar, Univ. of Chicago	Dec 2024
NPAC Forum, Univ. of Wisconsin	Oct 2024
LIM24 Meeting, Univ. of Illinois	Jun 2024
CCAT Collaboration Meeting 2023	Jun 2023
Present and Future of Line Intensity Mapping, Overview Talk	Apr 2023
Physics Colloquium, Univ. of Texas, Dallas	Mar 2023
Physics Colloquium, Southern Methodist Univ.	Mar 2023
KICP Seminar, Univ. of Chicago	Oct 2022
Astro Theory Seminar, Johns Hopkins Univ.	Oct 2022
Friday Extragalactic Seminar, Arizona State Univ.	Jul 2022
NASA-IRSTIG Webinar, Virtual	Apr 2022
CITA Cosmology Talk, Univ. of Toronto	May 2022
Brown Bag Seminar, New York Univ.	Sep 2020, Oct 2021
Special Seminar, Pennsylvania State Univ.	Feb 2020
ObsCos Seminar, Caltech	Nov 2019
Astronomy Seminar, Univ. of Pennsylvania	Oct 2019
Astronomy Seminar, NYU	Oct 2019
Cosmology Seminar, Perimeter Institute	Sep 2019
MSI Special Seminar, McGill Univ.	Sep 2019
Particle Theory Seminar, Johns Hopkins Univ.	Sep 2019
Cosmology Journal Club, Caltech	Aug 2018
Cosmology Visitors Program, UC Berkeley	Jan 2017
CosmoLunch Seminar, Ohio State Univ.	Oct 2016
Cosmology Discussion Seminar, CITA	Oct 2016
Loeb Group Meeting, Harvard/CFA	Sep 2016
BBL Seminar, MIT	Sep 2016
CosmoLunch, Princeton Univ.	Sep 2016
Poster Session, 66th Lindau Nobel Laureate Meeting	Jun 2016
HotSci, Space Telescope Science Institute	Jun 2016

Contributed Talks

TACOS 2023, Rice Univ	Oct 2023
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CMB+EoR Summer Workshop, McGill Univ.	Jul 2022
240th Meeting of the American Astronomical Society, Pasadena, CA	Jun 2022
UChicago/KICP Line Intensity Mapping Workshop 2021, Virtual	Jul 2021
235th Meeting of the American Astronomical Society, Honolulu, HI	Jan 2020
Lines in the Large-Scale Structure Meeting, Marseille, France	Jul 2019
Cosmology and Astrophysics with Intensity Mapping Workshop, CCA	Feb 2019
233rd Meeting of the American Astronomical Society, Seattle, WA	Jan 2019
COMAP Collaboration Meeting, OVRO	Aug 2018
Cosmological Signals from Cosmic Dawn to the Present, Aspen, CO	Feb 2018
231st Meeting of the American Astronomical Society, Washington D.C.	Jan 2018
Second Annual Intensity Mapping Workshop, Johns Hopkins Univ.	Jul 2017
229th Meeting of the American Astronomical Society, Seattle, WA	Jan 2017
Opportunities and Challenges in Intensity Mapping Workshop, Stanford Univ.	Mar 2016
COSMO 2015, Univ. of Warsaw	Sep 2015
225th Meeting of the American Astronomical Society, Seattle, WA	Jan 2015
Santa Fe Cosmology Workshop, St. Johns College	Jul 2014
223rd Meeting of the American Astronomical Society, Washington D.C.	Jan 2014

[CV compiled on 2025-11-25]