# Joel Meyers

Contact Information

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Citizenship: U.S. Citizen

Research Interests Theoretical Cosmology, Cosmic Microwave Background, Fundamental Physics

Research EXPERIENCE Southern Methodist University (SMU)

Department of Physics, 2018 - Present

Assistant Professor

Canadian Institute for Theoretical Astrophysics (CITA)

University of Toronto, 2012 - 2018

Senior Research Associate, Theoretical Cosmology

Weinberg Theory Group and Texas Cosmology Center

University of Texas at Austin, 2006 - 2012

Theoretical Cosmology, Dissertation research conducted with Prof. Steven Weinberg

EDUCATION

The University of Texas at Austin, Austin, Texas, USA

Ph.D. in Physics, August 2012

- Dissertation Topic: Inflation: Connecting Theory to Observation
- Advisor: Professor Steven Weinberg

University of Wisconsin, Madison, Wisconsin, USA

B.S. in Physics and Mathematics, May 2006

- Collaborations CMB-S4, 2015 present
  - Science Council Co-Chair 2020 present
  - Light Relics Working Group Co-Lead 2018 2019
  - Simons Observatory, 2016 present
  - **PICO**, 2016 present
  - CCAT-Prime, 2016 present

Funding and AWARDS

- Department of Energy High Energy Theory Grant, 2019 present
- Robert S. Hyer Award for Undergraduate Research (Faculty Supervisor), 2020
- Beatrice and Vincent Tremaine Fellowship, 2016 2017
- Texas Cosmology Center Summer Research Fellowship, 2010
- A.D. Hutchison Student Endowment Fellowship, 2009 2010
- Phi Beta Kappa, University of Wisconsin, 2006

### Postdocs Supervised

- Joseph Ryan, SMU, September 2021 present
- Cynthia Trendafilova, SMU, September 2019 August 2022; (CAPS Fellow at UIUC)

## GRADUATE STUDENTS SUPERVISED

- Antone Amalbert, Ph.D. Student, SMU, May 2023 present
- Alvin Leluc, Ph.D. Student, SMU, May 2023 present
- Jasmine Liu, (Co-supervisor), Ph.D. Student, SMU, August 2022 present
- Michael Litke, (Co-supervisor), M.S. Student, SMU, August 2022 August 2023
- Ishwita Saikia, (Co-supervisor), Ph.D. Student, SMU, August 2022 July 2023
- Brandon Stevenson, M.S. Student, SMU, May 2020 present
- Eric Guzman, Ph.D. Student, SMU, October 2018 May 2023
- Victor Chan, (Co-supervisor), Ph.D. Student, University of Toronto, Summer 2018 present
- Alex Laguë, Ph.D. Student, University of Toronto, Summer 2018 Fall 2019
- Selim Hotinli, (Co-supervisor), Ph.D. Student, Imperial College London, October 2016 May 2020
- Matthew Wilson, (Co-supervisor), M.S. student, University of Toronto, January August 2016
- Derek Inman, (Co-supervisor), Ph.D. Student, CITA, September 2013 August 2014

### Undergraduate

# STUDENTS

Supervised

• Joshua Ange, SMU, August 2022 - present

- Noah Pearson, SMU, May 2019 August 2021
- Connor Sheere, (Co-supervisor), CITA, Summer 2016 Summer 2018
- Brayden Mon, (Co-supervisor), CITA, Summer 2017
- Harrison Winch, (Co-supervisor), CITA, Summer 2016
- Vivian Britto, CITA, Summer 2014
- Shenglin Jing, (Co-supervisor), CITA, September 2012 August 2013

### INVITED TALKS

- Seminar / Colloquium: 29
- Conference / Workshop Plenary Talk: 33
- Selected Invited Talks:
  - Stony Brook University, C.N. Yang Institute Seminar, November 2023
  - University of Texas at Arlington, Physics Colloquium, March 2023
  - University of Illinois, CAPS Seminar, October 2022
  - Cosmological Probes of New Physics, University of Maryland, September 2022
  - Collider, Dark Matter, and Neutrino Physics 2022, Texas A&M University, May 2022
  - AAS 240, CMB Special Session, June 2022
  - APS April Meeting, Neutrino Mini-Symposium, April 2022
  - CosmoPalooza, Virtual, January 2022
  - Illinois Institute of Technology, Physics Colloquium, November 2020
  - Michigan State University, High Energy Physics Seminar, November 2020
  - Topics in Cosmic Neutrino Physics, Fermilab, October 2019
  - Institute for Advanced Study (Princeton), Astrophysics Seminar, May 2019
  - nu Physics in the CMB, University of California, San Diego, November 2018
  - University of Texas at Dallas, Physics Colloquium, October 2018
  - University of Texas at Austin, Theory Group Seminar, October 2018

### SUMMER SCHOOL LECTURER

- International Neutrino Summer School 2023, Fermilab, August 2023
- Michigan Cosmology Summer School 2023, University of Michigan, June 2023
- SLAC Summer Institute 2017, SLAC, August 2017

### Workshops Organized

- Theoretical Astroparticle and Cosmology Symposium in Texas, Rice U., October 2023
- CMB-S4 Spring 2023 Collaboration Meeting, Virtual, April 2023
- Theoretical Astroparticle and Cosmology Symposium in Texas, SMU, October 2022
- CMB-S4 Summer 2022 Collaboration Meeting, U. Chicago, August 2022
- 13th CMB-S4 Workshop: 2021 Summer Collaboration Meeting, August 2021
- 11th CMB-S4 Workshop: Cosmology and Astrophysics in the Next Decade, July 2020
- CMB in HD, Flatiron Institute, December 2018
- Neutrinos and (G)astrophysics in Large-Scale Structure, CITA, December 2016

### TEXTBOOKS WRITTEN

 Instructor's Solution Manual for Lectures on Quantum Mechanics by Steven Weinberg, Cambridge University Press, 2015

### TEACHING EXPERIENCE

#### Instructor

#### • SMU Courses:

- Foundations of Modern Cosmology PHYS 4368/6368
  - Quantum Field Theory II PHYS 7315
  - Quantum Mechanics II PHYS 6336
  - Foundations of Physics PHYS 6160
  - Modern Physics PHYS 3305
  - General Physics PHYS 1307
- Astro-eXtraordinary SCI 4301
- International Neutrino Summer School 2023, Fermilab, August 2023
- Michigan Cosmology Summer School 2023, University of Michigan, June 2023
- SLAC Summer Institute 2017, SLAC, August 2017
- Scientific Computing Symbolic Computing, May 2016 and May 2017, CITA

### SERVICE AND LEADERSHIP

#### • SMU Physics Department Committees:

- Seminar Series: Co-organizer, 2022 present
- Faculty Hiring Committee: Chair, 2022 2023; Member, 2018 2019, 2023 present
- Undergraduate Committee: Member, 2020 2023
- Graduate Curriculum Task Force: Member, Fall 2020 Spring 2021
- Graduate Committee: Member, 2018 2020, 2023 present
- Astrophysics Discussion: Co-organizer, 2019 2022
- Theoretical HEP Discussion: Co-organizer, 2018 2020

### • SMU University Service:

- Guild of Marshals: August 2020 - present

### • CMB-S4 Leadership:

- Science Council Co-Chair: 2020 - present

- Executive Team Member: 2020 present
- Light Relics Working Group Co-Lead: 2018 2019
- Workshop Organizer: 2020 presesnt

#### • CCAT-prime Leadership:

- Rayleigh Scattering Working Group Deputy Lead: 2020 - present

#### • CITA Committees:

- Cosmology Discussion: Co-organizer, 2012 2018
  Blackboard Discussion: Co-organizer, 2013 2018
  Postdoc Hiring Committee: Member, 2013 2018
- Jamboree: Co-organizer, 2014 2015

### • Funding Review Panels:

- NASA
- Department of Energy
- European Research Council
- US-Israel Binational Science Foundation
- Royal Society

#### • Textbook Reviews:

- Elsevier
- Cambridge University Press

#### • Journal Referee:

- Physical Review Letters
- Physical Review D
- Physical Review X
- Journal of Cosmology and Astroparticle Physics

**PUBLICATIONS** 

**Note**: Conventions for author ordering vary significantly within the field of cosmology. The typical practice for researchers with a background in high energy theory (including me) is to use alphabetical author lists by default. Exceptions are often made to boost visibility of students or junior researchers by placing them first in the list. In this section, author lists are alphabetical except those labeled with an asterisk (\*).

1. J. Ange and J. Meyers,

Improving Constraints on Models Addressing the Hubble Tension with CMB Delensing,

JCAP **10**, 045 (2023) arXiv:2307.01662 [astro-ph.CO]].

2. V. C. Chan, R. Hložek, J. Meyers and A. van Engelen,

Small Correlated Against Large Estimator (SCALE) for Cosmic Microwave Background Lensing,

arXiv:2302.13350 [astro-ph.CO], Accepted to PRD.

3. (\*) J. Ryan, B. Stevenson, C. Trendafilova and J. Meyers,

Beyond Fisher Forecasting for Cosmology,

Phys. Rev. D **105**, no.4, 044005 (2022) arXiv:2211.06534 [astro-ph.CO].

4. (\*) Y. Zhu, B. Beringue, S. K. Choi, N. Battaglia, P. D. Meerburg and J. Meyers, Estimating the Impact of foregrounds on the Future Detection of Rayleigh scattering,

JCAP **09** (2022), 048 arXiv:2205.04496 [astro-ph.CO].

 (\*) S. C. Hotinli, J. Meyers, C. Trendafilova, D. Green and A. van Engelen, The Benefits of CMB Delensing, JCAP 04, no.04, 020 (2022) arXiv:2111.15036 [astro-ph.CO].

6. D. Green and J. Meyers,

Cosmological Implications of a Neutrino Mass Detection, arXiv:2111.01096 [astro-ph.CO].

7. (\*) T. Namikawa, A. B. Lizancos, N. Robertson, B. D. Sherwin, A. Challinor, D. Alonso, S. Azzoni, C. Baccigalupi, E. Calabrese and J. Carron, et al.

The Simons Observatory: Constraining inflationary gravitational waves with multi-tracer B-mode delensing,

Phys. Rev. D **105**, no.2, 023511 (2022) arXiv:2110.09730 [astro-ph.CO].

8. E. Guzman and J. Meyers,

Reconstructing Cosmic Polarization Rotation with ResUNet-CMB, JCAP **01**, no.01, 030 (2022) arXiv:2109.09715 [astro-ph.CO].

9. M. Aravena et al. [CCAT-Prime],

CCAT-prime Collaboration: Science Goals and Forecasts with Prime-Cam on the Fred Young Submillimeter Telescope,

Astrophys. J. Suppl. **264**, no.1, 7 (2023) arXiv:2107.10364 [astro-ph.CO]

10. M. J. Bustamante-Rosell, J. Meyers, N. Pearson, C. Trendafilova and A. Zimmerman, Gravitational Wave Timing Array,

Phys. Rev. D **105**, no.4, 044005 (2022) arXiv:2107.02788 [gr-qc].

11. P. C. Breysse, S. Foreman, L. C. Keating, J. Meyers and N. Murray, Mapping the Universe in HD,

Phys. Rev. D **105**, no.8, 083009 (2022), **Editor's Suggestion** arXiv:2104.06422 [astro-ph.CO].

12. E. Guzman and J. Meyers,

Reconstructing Patchy Reionization with Deep Learning, Phys. Rev. D **104**, no.4, 043529 (2021) arXiv:2101.01214 [astro-ph.CO].

13. (\*) N. Pearson, C. Trendafilova and J. Meyers, Searching for Gravitational Waves with Strongly Lensed Repeating Fast

Radio Bursts, Phys. Rev. D **103**, no.6, 063017 (2021) arXiv:2009.11252 [astro-ph.CO].

14. K. Abazajian et al. [CMB-S4 Collaboration],

CMB-S4: Forecasting Constraints on Primordial Gravitational Waves, Astrophys. J. **926**, no.1, 54 (2022) arXiv:2008.12619 [astro-ph.CO].

15. (\*) B. Beringue, P. D. Meerburg, J. Meyers and N. Battaglia, Cosmology with Rayleigh Scattering of the Cosmic Microwave Background, JCAP 01, 060 (2021) arXiv:2008.11688 [astro-ph.CO].

16. S. C. Hotinli, M. C. Johnson and J. Meyers,

Optimal filters for the moving lens effect,

Phys. Rev. D 103, no.4, 043536 (2021) arXiv:2006.03060 [astro-ph.CO].

17. A. Laguë and J. Meyers,

Prospects and Limitations for Constraining Light Relics with Primordial Abundance Measurements,

Phys. Rev. D **101** (2020) no.4, 043509 arXiv:1908.05291 [astro-ph.CO].

18. K. Abazajian et al. [CMB-S4 Collaboration],

CMB-S4 Science Case, Reference Design, and Project Plan, arXiv:1907.04473 [astro-ph.IM].

19. (\*) S. Hanany et al. [NASA PICO Collaboration],

PICO: Probe of Inflation and Cosmic Origins, arXiv:1902.10541 [astro-ph.IM].

20. (\*) S. C. Hotinli *et al.*,

Transverse Velocities with the Moving Lens Effect, Phys. Rev. Lett. **123**, no. 6, 061301 (2019) arXiv:1812.03167 [astro-ph.CO].

(\*) S. Foreman, P. D. Meerburg, J. Meyers and A. van Engelen,
 Cosmic variance mitigation in measurements of the integrated Sachs-Wolfe effect,

Phys. Rev. D **99**, 083506 (2019) arXiv:1811.00529 [astro-ph.CO].

22. J. Aguirre *et al.* [Simons Observatory Collaboration], **The Simons Observatory: Science goals and forecasts**, JCAP **1902**, 056 (2019) arXiv:1808.07445 [astro-ph.CO].

23. (\*) G. J. Stacev et al.,

CCAT-prime: Science with an Ultra-widefield Submillimeter Observatory at Cerro Chajnantor,

arXiv:1807.04354 [astro-ph.GA].

- R. de Putter, O. Doré, J. Gleyzes, D. Green and J. Meyers,
   Dark Matter Interactions, Helium, and the CMB,
   Phys. Rev. Lett. 122, 041301, (2018) arXiv:1805.11616 [astro-ph.CO].
- D. Green, P. D. Meerburg and J. Meyers,
   Aspects of Dark Matter Annihilation in Cosmology,
   JCAP 1904, 025 (2019) arXiv:1804.01055 [astro-ph.CO].
- 26. (\*) S. Foreman, P. D. Meerburg, A. van Engelen and J. Meyers, Lensing reconstruction from line intensity maps: the impact of gravitational nonlinearity, JCAP 1807, no. 07, 046 (2018) arXiv:1803.04975 [astro-ph.CO].
- 27. (\*) S. C. Hotinli, J. Frazer, A. H. Jaffe, J. Meyers, L. C. Price and E. R. M. Tarrant, Effect of reheating on predictions following multiple-field inflation, Phys. Rev. D 97, no. 2, 023511 (2018) arXiv:1710.08913 [astro-ph.CO].
- 28. (\*) J. Meyers, P. D. Meerburg, A. van Engelen and N. Battaglia, Beyond CMB Cosmic Variance Limits on Reionization with the Polarized SZ effect, Phys. Rev. D 97, no. 10, 103505 (2018), Editor's Suggestion arXiv:1710.01708 [astro-ph.CO].
- P. D. Meerburg, J. Meyers and A. van Engelen,
   Reconstructing the Primary CMB Dipole,
   Phys. Rev. D 96, no. 8, 083519 (2017) arXiv:1704.00718 [astro-ph.CO].
- 30. P. D. Meerburg, J. Meyers, K. M. Smith and A. van Engelen, Reconstructing CMB Fluctuations and the Mean Reionization Optical Depth, Phys. Rev. D 95, no. 12, 123538 (2017) arXiv:1701.06992 [astro-ph.CO].
- 31. (\*) C. Sheere, A. van Engelen, P. D. Meerburg and J. Meyers, Establishing the Origin of CMB B-mode Polarization, Phys. Rev. D 96, no. 6, 063508 (2017) arXiv:1610.09365 [astro-ph.CO].
- 32. K. N. Abazajian *et al.* [CMB-S4 Collaboration], **CMB-S4 Science Book, First Edition**, arXiv:1610.02743 [astro-ph.CO].
- 33. R. de Putter, O. Doré, D. Green and J. Meyers, Single-Field Inflation and the Local Ansatz: Distinguishability and Consistency, Phys. Rev. D 95, no. 6, 063501 (2017) arXiv:1610.00785 [hep-th].
- 34. D. Green, J. Meyers and A. van Engelen, **CMB Delensing Beyond the B Modes**, JCAP **1712** (2017) no.12, 005 arXiv:1609.08143 [astro-ph.CO].
- 35. (\*) P. D. Meerburg, J. Meyers, A. van Engelen and Y. Ali-Haïmoud, **CMB B-Mode Non-Gaussianity**, Phys. Rev. D **93**, 123511 (2016) arXiv:1603.02243 [astro-ph.CO].
- 36. D. Baumann, D. Green, J. Meyers and B. Wallisch, **Phases of New Physics in the CMB**, JCAP **1601**, 007 (2016) arXiv:1508.06342 [astro-ph.CO].

37. (\*) P. D. Meerburg, R. Hložek, B. Hadzhiyska and J. Meyers, Multiwavelength Constraints on the Inflationary Consistency Relation, Phys. Rev. D 91, no. 10, 103505 (2015) arXiv:1502.00302 [astro-ph.CO].

38. M. Alvarez et al.,

Testing Inflation with Large Scale Structure: Connecting Hopes with Reality,

arXiv:1412.4671 [astro-ph.CO].

39. V. Britto and J. Meyers,

Monthly Modulation in Dark Matter Direct-Detection Experiments, JCAP 1511, 006 (2015) arXiv:1409.2858 [astro-ph.CO].

40. J. Meyers and E. R. M. Tarrant,

Perturbative Reheating After Multiple-Field Inflation: The Impact on Primordial Observables,

Phys. Rev. D **89**, no. 6, 063535 (2014) arXiv:1311.3972 [astro-ph.CO].

41. J. Meyers,

Non-Gaussian Correlations Outside the Horizon in Local Thermal Equilibrium,

arXiv:1212.4438 [astro-ph.CO].

42. J. Meyers and N. Sivanandam,

Adiabaticity and the Fate of Non-Gaussianities: The Trispectrum and Beyond,

Phys. Rev. D 84, 063522 (2011) arXiv:1104.5238 [astro-ph.CO].

43. J. Meyers and N. Sivanandam,

Non-Gaussianities in Multifield Inflation: Superhorizon Evolution, Adiabaticity, and the Fate of fnl,

Phys. Rev. D 83, 103517 (2011) arXiv:1011.4934 [astro-ph.CO].

44. W. Fischler and J. Meyers,

Dark Radiation Emerging After Big Bang Nucleosynthesis?,

Phys. Rev. D 83, 063520 (2011) arXiv:1011.3501 [astro-ph.CO].

#### Snowmass 2021 Papers

The papers in this section were written for the Snowmass 2021 DPF Community Planning Exercise. Papers in this section do not have alphabetical authors lists. Those which I co-led are indicated by (‡), and those for which I was among the primary authors are indicated by (†).

45. R. X. Adhikari, et al.

Report of the Topical Group on Cosmic Probes of Fundamental Physics for for Snowmass 2021,

arXiv:2209.11726 [hep-ph].

46. B. Flaugher, V. Miranda, D. J. Schlegel et al.

Report of the Topical Group on Dark Energy and Cosmic Acceleration:

Complementarity of Probes and New Facilities for Snowmass 2021, arXiv:2209.08654 [astro-ph.CO].

- 47. A. Drlica-Wagner, C. Prescod-Weinstein, H. B. Yu *et al.* Report of the Topical Group on Cosmic Probes of Dark Matter for Snowmass 2021, arXiv:2209.08215 [hep-ph].
- D. Green, J. T. Ruderman, B. R. Safdi, J. Shelton et al. Snowmass Theory Frontier: Astrophysics and Cosmology, arXiv:2209.06854 [hep-ph].
- 49. J. A. Blazek et al.

Snowmass2021 Cosmic Frontier White Paper: Enabling Flagship Dark Energy Experiments to Reach their Full Potential, arXiv:2204.01992 [astro-ph.CO].

50. (†) R. Brito *et al.* 

Snowmass2021 Cosmic Frontier White Paper: Probing dark matter with small-scale astrophysical observations, arXiv:2203.15954 [hep-ph].

51. (†) C. L. Chang, K. M. Huffenberger et al.

 ${\bf Snowmass2021\ Cosmic\ Frontier:\ Cosmic\ Microwave\ Background\ Measurements\ White\ Paper,}$ 

arXiv:2203.07638 [astro-ph.CO].

52. (†) K. Abazajian *et al.* [CMB-S4 Collaboration], Snowmass 2021 CMB-S4 White Paper, arXiv:2203.08024 [astro-ph.CO].

53. (‡)(†) C. Dvorkin, J. Meyers *et al.* The Physics of Light Relics,

arXiv:2203.07943 [hep-ph].

54. (†) C. Dvorkin, R. Hlozek,  $et\ al.$ 

Dark Matter Physics from the CMB-S4 Experiment, arXiv:2203.07064 [hep-ph].

55. (†) K. N. Abazajian et al.

Synergy between cosmological and laboratory searches in neutrino physics: a white paper,

arXiv:2203.07377 [hep-ph].

56. (†) E. J. Baxter, C. Chang, A. Hearin  $\it et~\it al.$ 

Snowmass2021: Opportunities from Cross-survey Analyses of Static Probes, arXiv:2203.06795 [hep-ex].

57. S. Aiola et al. [CMB-HD],

Snowmass2021 CMB-HD White Paper, arXiv:2203.05728 [astro-ph.CO].

### Astro2020 Decadal Survey White Papers

The papers in this section were written for the Astro2020 Decadal Survey of Astronomy and Astrophysics. Papers in this section do not have alphabetical authors lists, and those for which I was among the primary authors are indicated by (†).

58. N. Sehgal, et al.,

CMB-HD: Astro2020 RFI Response, arXiv:2002.12714 [astro-ph.CO].

59. T. Herter et al.,

The CCAT-Prime Submillimeter Observatory,

Bull. Am. Astron. Soc. 51, no. 7, 213 (2019) arXiv:1909.02587 [astro-ph.IM].

60. S. Hanany et al.,

PICO: Probe of Inflation and Cosmic Origins,

Bull. Am. Astron. Soc. **51**, no. 7, 194 (2019) arXiv:1908.07495 [astro-ph.IM].

61. J. Carlstrom et al.,

CMB-S4.

Bull. Am. Astron. Soc. 51, no. 7, 209 (2019) arXiv:1908.01062 [astro-ph.IM].

62. A. Lee et al. [Simons Observatory Collaboration],

The Simons Observatory,

Bull. Am. Astron. Soc. **51**, no. 7, 147 (2019) arXiv:1907.08284 [astro-ph.IM].

63. N. Sehgal et al.,

CMB-HD: An Ultra-Deep, High-Resolution Millimeter-Wave Survey Over Half the Sky,

Bull. Am. Astron. Soc. **51**, no. 7, 6 (2019) arXiv:1906.10134 [astro-ph.CO].

- 64. (†) E. B. Grohs, J. R. Bond, R. J. Cooke, G. M. Fuller, J. Meyers and M. W. Paris, **Big Bang Nucleosynthesis and Neutrino Cosmology**, Bull. Am. Astron. Soc. **51**, no. 3, 412 (2019) arXiv:1903.09187 [astro-ph.CO].
- 65. (†) D. Green *et al.*,

Messengers from the Early Universe: Cosmic Neutrinos and Other Light Relics.

Bull. Am. Astron. Soc. **51**, no. 3, 159 (2019) arXiv:1903.04763 [astro-ph.CO].

66. S. Shandera et al.,

Probing the origin of our Universe through cosmic microwave background constraints on gravitational waves,

Bull. Am. Astron. Soc. **51**, no. 3, 338 (2019) arXiv:1903.04700 [astro-ph.CO].

67. P. D. Meerburg et al.,

Primordial Non-Gaussianity,

Bull. Am. Astron. Soc. **51**, no. 3, 107 (2019) arXiv:1903.04409 [astro-ph.CO].

68. N. Sehgal et al.,

Science from an Ultra-Deep, High-Resolution Millimeter-Wave Survey, Bull. Am. Astron. Soc. **51**, no. 3, 43 (2019) arXiv:1903.03263 [astro-ph.CO].

# Conference Proceedings

69. J. Meyers,

Cosmic Neutrinos and Other Light Relics, arXiv:1605.05575 [astro-ph.CO].