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GABRIELE MONTEFALCONE

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INSTITUTIONAL HISTORY

Doctor of Philosophy in Physics — Sep 2021 ▸ Now

University of Texas at Austin, Weinberg Institute for Theoretical Physics — *Austin,TX*

Advised by Katherine Freese

Bachelor of Arts in Physics — Sep 2016 ▸ Jun 2020

Princeton University, Department of Physics — *Princeton, NJ*

Senior Thesis (advised by Lyman Page): Exploring properties of galaxy clusters with the Atacama Cosmology Telescope

Junior Paper II (advised by Paul J. Steinhardt): Exploring extra dimensions with constraints on the variation of Newton's Constant

Junior Paper I (advised by Cristiano Galbiati): The DarkSide-LowMass Experiment and its Physics Potential

PAPERS

h-index 10, 217 total citations. ★ denotes papers with alphabetical author order in which I had major contributions.

Journal Publications

11. **GM**, B. Shams Es Haghi, T. Xu, K. Freese, *Thermal Gravitons from Warm Inflation*, Phys.Rev.D 112 (2025), 063556
10. **GM**, G. Elor, K. Boddy, N. Bellomo, *CMB Constraints on Loop-Induced Decays of Leptophilic Dark Matter*, Phys.Rev.D 112 (2025) 2, 023506
9. **GM**, B. Wallisch, K. Freese, *Free-Streaming Neutrinos and Their Phase Shift in Current and Future CMB Power Spectra*, JCAP 08 (2025) 051
8. ★ K. Boddy, K. Freese, **GM**, B. Shams Es Haghi, *Minimal Dark Matter Freeze-in with Low Reheating Temperatures and Implications for Direct Detection*, Phys.Rev.D 111 (2025) 6, 063537
7. ★ K. Freese, **GM**, B. Shams Es Haghi, *Dark Matter production during Warm Inflation via Freeze In*, PhysRevLett.133.211001
6. **GM**, Rudnei O. Ramos, Gustavo S. Vicente, K. Freese, *Defying eternal inflation in warm inflation with a negative running*, JCAP 02 (2024) 006
5. **GM**, V. Aragam, L. Visinelli, K. Freese, *WarmSPy: a numerical study of cosmological perturbations in warm inflation*, JCAP01(2024)032
4. **GM**, V. Aragam, L. Visinelli, K. Freese, *Observational constraints on warm natural inflation*, JCAP 03 (2023) 002
3. **GM**, V. Aragam, L. Visinelli, K. Freese, *Constraints on the scalar-field potential in warm inflation*, Phys.Rev.D 107 (2023) 6, 063543
2. **GM**, M. H. Abitbol, D.Kodwani, R.D.P. Grumitt, *Inpainting CMB maps using partial convolutional neural networks*, JCAP 03 (2021) 055
1. **GM**, P.J. Steinhardt, D.H. Wesley, *Dark energy, extra dimensions, and the Swampland*, JHEP 06 (2020) 091

Preprints

5. **GM**, S. Ghosh, K. Boddy, D. Wei Ren Ho, Y. Tsai, *Directly Probing Neutrino Interactions through CMB Phase Shift Measurements*, 2509.20363 (Submitted to PRD)
4. M. W. Toomey, **GM**, E. McDonough, K. Freese, *How Theory-Informed Priors Affect DESI Evidence for Evolving Dark Energy*, 2509.13318 (Submitted to PRD)

3. **GM**, H. A. G. Cruz, J. B. Munoz, E. D. Kovetz, M. Kamionkowski, *Tracing the Neutrino-Induced Phase Shift in the 21-cm Spectrum*, 2509.03595 (Submitted to PRD)
2. J. J. Ziegler, K. Freese, J, Lozano, **GM**, *Explaining the "too massive" high-redshift galaxies in JWST data: numerical study of three effects and a simple relation*, 2507.21409 (Submitted to MNRAS)
1. **GM**, D. Hooper, K. Freese, C. Kelso, F. Kuhnel, P. Sandick, *Does Memory Burden Open a New Mass Window for Primordial Black Holes as Dark Matter?*, 2503.21005 (Submitted to PRL)

Awards & Fellowships

Leonard Endowed Presidential Fellowship in Physics — Sept 2025 ▸ Now

Department of Physics, University of Texas at Austin

Awarded annualy to one member of the Department of Physics at the University of Texas At Austin. Stipend of $3,000 per month, tuition and insurance for the full academic year included.

Summer Excellence 2025 Fellowship — Jun 2025 ▸ Sep 2025

Graduate School, University of Texas at Austin

Awarded annualy by the University of Texas Graduate School. Stipend of $9,000, tuition and insurance for the summer term included.

Graduate School Continuing Fellowship — Jun 2024 ▸ Jun 2025

Graduate School, University of Texas at Austin

Awarded by the University of Texas Graduate School, based on major accomplishments and a well-defined research program. Stipend of $36,000, tuition and insurance for full academic year included.

Steven Weinberg Summer Fellowship — May 2023 ▸ Aug 2023

Texas Center for Cosmology and Astroparticle Physics (TCCAP), University of Texas at Austin

Awarded annually to one member of the TCCAP. Stipend of $7,500, tuition and insurance for the summer term included.

A. G. Shenstone Prize Winner in Physics — Jun 2018 - Jun 2019

Department of Physics, Princeton University

Recognizes annually outstanding Physics undergraduates who have shown excellence in course work and promise in independent research. Awarded prize of $750.

Collaboration Memberships

Simons Observatory (SO) — Jun 2025 ▸ Now

Member of the Likelihood and Theory Group. Currently contributing to the implementation in SO of the analysis pipeline for extracting the neutrino-induced phase shift from CMB data, developed in my own work.

Research Presentations

Invited Talks

5. Mitchell Institute Seminar — Sept 2025
   Department of Physics, Texas A & M University — *College Station, TX*
   Probing Cosmic Neutrinos and Free-Streaming Radiation with the CMB
4. Theoretical Astroparticle & COsmology Symposium in Texas — Oct 2024
   Department of Physics, University of Texas at Austin — *Austin, TX*
   Free-streaming neutrinos in the CMB power spectra
3. Particle Production and Thermal Effects in Inflation — Feb 2024
   Physics Department, King's College London — *Virtual on Zoom*
   Dark Matter Production during Warm Inflation via Freeze In

2. Cosmology-Astro Seminar — Oct 2023
Leinweber Center for Theoretical Physics, University of Michigan — *Ann Arbor, MI*
The Imprint of cosmic neutrinos & other light-relics in the CMB

1. Theoretical Cosmology Seminar — Jun 2023
CoPS division, the Oskar Klein Center, Department of Physics, Stockholm University — *Stockholm, Sweden*
Warm Inflation: Warm Natural inflation and other recent developments

Contributions to Conferences and Workshops

7. XVIII International Conference on Interconnections between Particle Physics and Cosmology — Jun 2025
The Institute of Underground Science at SURF — *Deadwood, SD*
Probing Cosmic Neutrinos and Free-Streaming Radiation with the CMB

6. TeV Particle Astrophysics 2024 — Aug 2024
Department of Physics, University of Chicago — *Chicago, IL*
Minimal Dark Matter Freeze-in with Low Reheating Temperatures & Implications for Direct Detection

5. Workshop on Quantum Aspects of Inflationary Cosmology — Jul 2024
Munich Institute of Astro-,Particle & BioPhysics — *Munich, Germany*
WIFI A novel framework for Dark Matter production

4. International Workshop on the Identification of Dark Matter — Jul 2024
Gran Sasso Science Institute — *L'Aquila, Italy*
Minimal Dark Matter Freeze-in with Low Reheating Temperatures & Implications for Direct Detection

3. Cosmology from Home — June 2024
Online Conference — *Virtual on Zoom*
Minimal Dark Matter Freeze-in with Low Reheating Temperatures & Implications for Direct Detection

2. Neutrinos from Home — Apr 2024
Online Conference — *Virtual on Zoom*
The Imprint of cosmic neutrinos & other light-relics in the CMB

1. The Future of High Energy Physics, A New Generation, A New Vision — Mar 2024
Aspen Center for Physics — *Aspen, CO*
WIFI: A novel framework for Dark Matter Production

At the University of Texas at Austin

3. Weinberg Institute, Brown Bag Seminar
Free-streaming neutrinos in the CMB power spectra — Feb 2025
The Imprint of cosmic neutrinos & other light-relics in the CMB — Nov 2023
Warm Natural Inflation — Jan 2023

2. Physics Concerto Seminar Series
What every physicist should know about the Cosmic Microwave Background — Sep 2024
Beyond the Big Bang: Delving into Inflationary Cosmology — Oct 2023

1. Physics Department, Pizza Seminar
Free-streaming neutrinos & the cosmic microwave background — Nov 2024

VISITS

University of Michigan Oct 15 ▸ 20 2023
Leinweber Center for Theoretical Physics, University of Michigan *Ann Arbor, MI*
Visiting Researcher

Stockholm University Jun 1 ▸ 30 2023
Oscar Klein Center, Department of Physics, Sotckholm University *Stockholm, Sweden*
Visiting Researcher

Oxford University Jun 1 ▸ Aug 10 2019
Department of Astrophysics, Oxford University *Oxford, United Kingdom*
Research Intern

Outreach & Scientific Service

CMBverse Jun 2024 ▸ Now
Department of Physics, University of Texas at Austin *Austin, TX*
CMBverse.com
I guide a team of high school and undergraduate students in creating interactive animations that let students explore the effects of cosmological parameters on the Cosmic Microwave Background. Hosted on our website, CMBverse, these tools are designed to make learning cosmology more engaging and accessible.

APS DGRAV Student Representative Apr 2024 ▸ Now
The American Physical Society, Division of Gravitational Physics *College Park, MD*

Physics Concerto Seminar Series Sep 2023 ▸ Now
Department of Physics, University of Texas at Austin *Austin, TX*
physicsconcerto.com
Founder and organizer of the Physics Concerto, a peer-to-peer seminar series with the aim of enabling graduate students to delve into fields and roles beyond their own concentration at an advanced, yet comprehensible, level.

Member of the Local Organizing Committee, TACOS Aug 2024 ▸ Oct 2024
Department of Physics, University of Texas at Austin *Austin, TX*
Contributed to organizing the annual Theoretical Astroparticle & COsmology Symposium (TACOS); a meeting that unites researchers in theoretical particle physics, astrophysics, and cosmology across Texas, facilitating discussions on the latest developments, and promoting collaboration among faculty, postdocs, and students from the different institutions.

Teaching

Teaching Assistant
University of Texas at Austin Fall 2021 ▸ Spring 2023
Supported courses in Modern Physics (Phy 355), General Physics II (Phy 303k), and Plan II Modern Physics (Phy 321). Led discussion sections, assisted with grading, and in particular taught three lectures on special relativity, general relativity, and the cosmic microwave background.
Princeton University Fall 2020 ▸ Spring 2021
Supported introductory courses in Classical Mechanics (Phy 101) and Electromagnetism (Phy 102, Phy 104). Led labs, graded homework, and contributed to textbook revisions for Phy 104.

Skills & Interests

</> Digital Competence
Data Analysis in Python, Programming in Mathematica and C++; Machine Learning with Keras; Proficient user in LaTeX.
Languages

Native Italian; Proficient English; Intermediate Spanish.

Past Athletics Career

Former Professional 400m hurdler, Top-10 Italian All-Time (49.15s in 400hs), Captain of the Princeton Track Team.

Other Interests

Italian Cooking; Motorcycle Riding; Backpacking; Running 2 miles every day until my legs hold up.