



Marcell Howard

Curriculum Vitae

PERSONAL DETAILS

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RESEARCH INTERESTS

Cosmological Gravitational Wave Backgrounds, Quantum Field Theory in Curved Spacetime, Early Universe Cosmology, Quantum Cosmology, Gravitational Particle Production, Primordial Black Holes, Modifications of General Relativity

EDUCATION

University of Pittsburgh, Pittsburgh, PA *2019 - Present*
Ph.D., Physics

Case Western Reserve University, Cleveland, OH *2015 - 2019*
B.S., Mathematics and Physics

RESEARCH EXPERIENCE

Graduate Research Assistant *2020 - Present*
University of Pittsburgh advised by Arthur Kosowsky
Doctoral Thesis: Issues of Gravitation in Cosmology

Senior Project *2018 - 2019*
Case Western Reserve University advised by Kurt Hinterbichler
Honor's Thesis: The People vs Mimetic Gravity

Research Experience for Undergraduates *Summer 2018*
Rutgers, the State University of New Jersey advised by Andrew Baker
Probing the Evolution of Galaxies Using Stellar Mass Selected Samples

Research Experience for Undergraduates *Summer 2017*
Cornell University advised by Gordon Stacey
Using Far-Infrared Fine-Structure Lines for Characterizing Star
Formation Processes in Nearby Galaxies

FELLOWSHIPS, SCHOLARSHIPS AND AWARDS

Peter F.M. Koehler Pre-Doctoral Fellowship *2023*
Competitive internal department fellowship for excellence in teaching and research

2021 Honorable Mention, Ford Foundation Predoctoral Fellowship *2021*

**Dietrich School of Arts and Sciences Summer Research
Predoctoral Fellowship**

2020

Kenneth P. Dietrich School of Arts & Sciences Fellowship

2019

Awarded to incoming graduate students for recognition of an outstanding undergraduate record

Case Alumni Junior/Senior Scholarship

2017

Awarded to rising sophomores and juniors pursuing a BS in engineering, math, or the applied sciences based on merit, need and personal skills

PUBLICATIONS LIST

- M. Howard and M. König, *Elastic scattering of cosmological gravitational wave backgrounds: primordial black holes and stellar objects*, J. Cosmology Astropart. Phys. **2024** (2024) 045 [2309.15925]
- T. Daniel, M. Howard and M. König, *An SZ-like effect on cosmological gravitational wave backgrounds*, J. Cosmology Astropart. Phys. **2023** (2023) 041 [2308.00111]
- S. Alexander, T. Daniel, M. Howard and M. König, *Exact fermionic Chern-Simons-Kodama state in quantum gravity*, Phys. Rev. D **106** (2022) 106012 [2207.11856]
- M. Howard, A. Kosowsky and G. Valogiannis, *Galaxy Cluster Statistics in Modified Gravity Cosmologies*, *arXiv e-prints* (2022) arXiv:2205.13015 [2205.13015]

TEACHING EXPERIENCE

Guest Lecturer

PHYS 3726: General Relativity 2

General Relativity as a Quantum Field Theory

Graduate Teaching Assistant

PHYS 0111: Introduction to Physics 2

PHYS 0174: Basic Physics for Science and Engineering 1

PHYS 0175: Basic Physics for Science and Engineering 2

PHYS 0212: Introduction to Laboratory Physics

- Held two-four recitation sessions per week.
- Graded quizzes and tests.

Graduate Core Course Departmental Tutor

PHYS 2565: Non-Relativistic Quantum Mechanics 1

PHYS 2566: Non-Relativistic Quantum Mechanics 2

PHYS 1373 & 2373 (Combined section): Mathematical Methods in Physics

- Held two office hours per week.
- Provided homework help as well as furthered conceptual understanding of the material.

Undergraduate Supplemental Instructor

MATH 121: Calculus for Scientists and Engineers I

MATH 122: Calculus for Scientists and Engineers II

- Held three small groups and one recitation session per week.

- Graded quizzes and tests.

Undergraduate Teaching Assistant

PHYS 121: General Physics I - Mechanics

PHYS 122: General Physics II - Electricity and Magnetism

- Graded written homework handed in every week.
- Handed out in-class assignments and provided help to various students.

TALKS AND POSTER PRESENTATIONS

Syracuse University Colloquium

Nov 2023

Current and Future Constraints on Primordial Black Holes as Dark Matter Candidates

Invited talk

Syracuse University, Watson Cosmology Group Seminar

Nov 2023

Formalism of the Gravitational Sunyaev-Zeldovich Effect

Invited talk

National Society of Black Physicists Conference

Nov 2023

The Gravitational Sunyaev-Zeldovich Effect as a Probe of Primordial Black Holes as Dark Matter Candidates

Contributed talk

28th International Symposium on Particles, Strings, and Cosmology

June 2023

An SZ-Like Effect On Stochastic Gravitational Wave Backgrounds

Invited talk

Simons Center for Geometry and Physics,

Ending Inflation and the Hot Big Bang Workshop

June 2023

An SZ-Like Effect On Stochastic Gravitational Wave Backgrounds

Invited talk

American Physical Society April Meeting 2023

Apr 2023

An SZ-Like Effect On Stochastic Gravitational Wave Backgrounds

Contributed talk

Pennsylvania State University, Neighborhood Workshop

Apr 2023

An SZ-Like Effect On Stochastic Gravitational Wave Backgrounds

Contributed talk

Massachusetts Institute of Technology, String Theory Group Meeting

Feb 2023

An Exact Fermionic Chern-Simons-Kodama State in Quantum Gravity

Invited talk

National Society of Black Physicists Conference

Nov 2022

An Exact Fermionic Chern-Simons-Kodama State in Quantum Gravity

Contributed talk

Case Western Reserve University, Particle Astrophysics Seminar

Sep 2022

An Exact Fermionic Chern-Simons-Kodama State in Quantum Gravity

Invited talk

NEXUS Summer Workshop

Aug 2022

An Exact Fermionic Chern-Simons-Kodama State in Quantum Gravity

Contributed talk

American Physical Society April Meeting 2022

Apr 2022

Galaxy Cluster Statistics in Modified Gravity Cosmologies

Contributed talk

Brown University, Alexander Lab Group Meeting

Mar 2022

Galaxy Cluster Statistics in Modified Gravity Cosmologies

Invited talk

National Society of Black Physicists Conference <i>Galaxy Cluster Statistics in Modified Gravity Cosmologies</i> Contributed talk	<i>Nov 2021</i>
American Astronomical Society Meeting (Seattle, WA) <i>Probing the Evolution of Galaxies Using Stellar Mass Selected Samples</i> Contributed poster	<i>Jan 2019</i>
Rutgers, the State University of New Jersey, REU Presentation <i>Probing the Evolution of Galaxies Using Stellar Mass Selected Samples</i> Contributed poster and talk	<i>Aug 2018</i>
Cornell University, REU Presentation <i>Using Far-Infrared Fine-Structure Lines for Characterizing the Star Formation Processes in Nearby Galaxies</i> Contributed poster and talk	<i>Aug 2017</i>

OUTREACH AND SERVICE

Astrophysicist for a Day <i>Allegheny Observatory</i> Volunteer Workshop Leader: Rediscovering Our Accelerating Universe	<i>Mar 2024</i>
Society of Physics Students Graduate Student Panel <i>University of Pittsburgh</i> Panel contributor	<i>Dec 2023</i>
Python Boot Camp 2023: Functions and Modules <i>University of Pittsburgh</i> Volunteer Presenter	<i>May 2023</i>
Astronomy on Tap NYC <i>Pete's Candy Store</i> Invited talk	<i>May 2023</i>
International Baccalaureate Class Group Project <i>St Edward High School</i> Invited speaker	<i>Mar 2023</i>
Seminar at High School (SAHS) and Pathway Career Speaker Series <i>Woodland Hills High School</i> Invited speaker	<i>Dec 2022</i>
Society of Physics Students Graduate Student Panel <i>University of Pittsburgh</i> Panel contributor	<i>Oct 2022</i>
Astronomy on Tap <i>Two Fray's Brewery</i> Contributed talk	<i>Sept 2022</i>
Summer Seminar Series: So You Wanna Get Good At L^AT_EX <i>University of Pittsburgh</i> Contributed talk	<i>July 2022</i>
Cornell's Focus for Teens <i>Cornell University</i> Workshop Leader	<i>Summer 2017</i>

SCHOOLS PARTICIPATED

39th Advanced School in Theoretical Physics on Geometry, Topology and
Mechanics in Soft Condensed Matter

Jan 2024

Israel Institute for Advanced Study

Canceled due to war

SKILLS

Programming

Python, Mathematica, Matlab

Languages

Software

SciPy/matplotlib, AstroPy, git

PROFESSIONAL ORGANIZATIONS

Pittsburgh Particle Astrophysics and Cosmology Center (PITT PACC) *2020 - Present*

National Society of Black Physicists

2018 - Present