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University of Colorado
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Education

University of Colorado Boulder, Boulder, CO **2018 – 2024**
MS in Physics, 2020
PhD in Physics, 2024
Certificate in College Teaching (Center for Teaching & Learning), 2024

Case Western Reserve University, Cleveland, OH **2014 – 2018**
BA in Physics, BA in Music (piano, organ, harpsichord) **GPA: 4.0/4.0**
Minors in Astronomy, Mathematics

The Ohio State University, Columbus, OH **2013 – 2014**
PSEOP (pre-baccalaureate program) **GPA: 4.0/4.0**

Research Experience

University of Colorado Boulder, Dept. of Physics, Boulder, CO **2019 – Present**
PhD thesis. Advisor: Prof. Andrew Hamilton.
Modeling the interior of astrophysical black holes with rotation and accretion, using both classical and semiclassical physics.

Case Western Reserve University, Dept. of Physics, Cleveland, OH **2017 – 2018**
Undergraduate capstone thesis. Advisor: Prof. Glenn Starkman.
Constraining cosmic topology by analyzing the correlation matrices of the CMB for generalized flat fundamental domains.

University of Notre Dame, Dept. of Physics, South Bend, IN **Summer 2017**
Research Experience for Undergraduates (REU). Advisor: Prof. Umesh Garg.
Analyzed data from Gammasphere at Argonne National Laboratory to determine angular distributions and mixing ratios for ^{135}Pr nuclei.

National Solar Observatory, Boulder, CO **Summer 2016**
REU. Advisor: Dr. Gordon Petrie.
Studied the helicity distribution and global impact of a solar active region, attended 2016 conference of AAS Solar Physics Division and published article in *The Astrophysical Journal*.

Publications

- McMaken, T.** (2024). “Backreaction from quantum fluxes at the Kerr inner horizon” *Phys. Rev. D* (accepted). [↗](#)
- McMaken, T.** & Hamilton, A. J. S. (2024). “Hawking radiation inside a rotating black hole” *Phys. Rev. D*, 109, 065023. [↗](#)
- McMaken, T.** (2023). “Pancakification and negative Hawking temperatures” *Int. J. Mod. Phys. D*, 32, 14, 2342017. [↗](#)
- Jhurani, K. & **McMaken, T.** (2023). “Existence of time-like geodesics in asymptotically flat spacetimes: A generalized topological criterion” *Adv. Stud. Theor. Phys.*, 17, 3, 109-120. [↗](#)
- Hamilton, A. J. S. & **McMaken, T.** (2023). “Unification of the four forces in the Spin(11,1) geometric algebra” *Phys. Scr.* 98, 085306. [↗](#)
- McMaken, T.** (2023). “Semiclassical instability of inner-extremal regular black holes” *Phys. Rev. D*, 107, 125023. [↗](#)
- McMaken, T.** & Hamilton, A. J. S. (2023). “Hawking radiation inside a charged black hole” *Phys. Rev. D*, 107, 085010. [↗](#)
- Hamilton, A. J. S. & **McMaken, T.** (2022). “Wave equations in conformally separable, accreting, rotating black holes” *Phys. Rev. D*, 106, 124031. [↗](#)
- McMaken, T.** & Hamilton, A. J. S. (2022). “Renormalization of $\langle\phi^2\rangle$ at the inner horizon of rotating, accreting black holes” *Phys. Rev. D*, 105, 125020. [↗](#)
- McMaken, T.** (2022). “Notes on primordial black hole origin for thermal gamma-ray bursts” *MNRAS*, 511, 1, 1218–1223. [↗](#)
- McMaken, T.** & Hamilton, A. J. S. (2021). “Geometry near the inner horizon of a rotating, accreting black hole” *Phys. Rev. D*, 103, 084104. [↗](#)
- Sensharma, N. et al. (2019). “Two-phonon wobbling in 135Pr” *Phys. Lett. B*, 792, 170-4. [↗](#)
- McMaken, T.** & Petrie, G. (2017). “The Great Solar Active Region NOAA 12192: Helicity Transport, Filament Formation, and Impact on the Polar Field” *ApJ*, 840, 100. [↗](#)

Presentations

Invited

- “How quantum matter curves spacetime”
Center for Theory of Quantum Matter (CTQM) Student Seminar, Dept. of Physics, CU Boulder, April 2024.
- “Why you should care about what happens inside black holes”
APS Friday Lunch Seminar, Dept. of Astrophysical and Planetary Sciences, CU Boulder, September 2023.
- “Hawking radiation and semiclassical singularities inside black holes”
Center for Gravitation and Cosmology, Yangzhou University, Jiangsu Province, China (virtual), April 2023.

“Just how black are black holes?”

CU-Prime Talk Series, CU Boulder, September 2021. [↗](#)

“20,000 leagues under the ringularity: What’s inside of a black hole?”

CU-Prime Talk Series, CU Boulder, September 2019.

Contributed

“Negative-temperature Hawking radiation near the inner horizon, the outer horizon, and beyond”

APS April Meeting 2023, Minneapolis, Minnesota, April 2023. [↗](#)

“The singularity at the inner horizon of astrophysical black holes”

32nd Midwest Relativity Meeting, APS Division of Gravitational Physics (DGRAV), Oakland University, Michigan, October 2022.

“Renormalization of $\langle\phi^2\rangle$ at the inner horizon of rotating, accreting black holes”

APS April Meeting 2022, New York City, New York, April 2022. [↗](#)

“Geometry near the inner horizon of a rotating, accreting black hole”

APS April Meeting 2021, virtual, April 2021. [↗](#)

“Black hole interiors: Mass inflation and BKL collapse”

Black Holes Meeting, CU Boulder, November 2019.

Posters

“Hawking radiation around and inside rotating and accreting black holes”

Quantum Effects in Gravitational Fields, Leipzig University, Germany, August 2023.

“Evidence for Two-Phonon Transverse Wobbling in ^{135}Pr ”

2017 Fall Meeting, APS Division of Nuclear Physics (DNP), October 2017. [↗](#)

Media Mentions

Mann, Adam. “Black Holes Evaporate—Now Physicists Think Everything Else Does, Too.”

Scientific American, 22 June 2023. [↗](#)

Hughes-Castleberry, Kenna. “What Happens When You Fall into a Black Hole?” *JILA Light and*

Matter, 12 April 2023. [↗](#)

Grants & Fellowships

Carl Hansen Graduate Fellowship (2x)

CU Boulder, Dept. of Astrophysical and Planetary Sciences

**Spring 2024
& Fall 2021**

International Travel Grant

CU Boulder Graduate School

Fall 2023

Ray Mace Smith Graduate Fellowship

CU Boulder, Dept. of Astrophysical and Planetary Sciences

Spring 2023

Graduate Student Travel Grant (2x)

CU Boulder, Dept. of Astrophysical and Planetary Sciences

**Spring 2023
& Summer 2023**

Dissertation Completion Fellowship CU Boulder Graduate School, one semester of full funding	Fall 2022
Domestic Travel Grant CU Boulder Graduate School	Spring 2022
Division of Gravitational Physics (DGRAV) Travel Grant American Physical Society	Spring 2022
NSF Graduate Research Fellowships Program (GRFP): Honorable Mention National Science Foundation	Spring 2020
Richard and Peggy Notebaert Fellowship (declined) University of Notre Dame, 5-year graduate fellowship & full tuition coverage	Spring 2018
Conference Experience for Undergraduates Award Funding American Physical Society Division of Nuclear Physics (DNP)	Fall 2017

Awards & Honors

Dean's Innovation Fund Award College of Arts and Sciences, CU Boulder, \$38,720 For the co-development of "Research Beyond Borders: Poster Symposium and Research Fellowship for Underrepresented and Minority Groups in STEM"	2024
Gravity Research Foundation 2023 Awards for Essays on Gravitation Honorable Mention 🔗	2023
R. N. Thomas Award JILA, CU Boulder, \$3,000	2022
Physics Award for Outstanding Graduate Student Service (3x) CU Boulder Dept. of Physics	Spring 2024 & Spring 2023 & Fall 2021
Physics Award for TA Excellence CU Boulder Dept. of Physics	Fall 2020
Graduate Part Time Instructor Appreciation Award CU Boulder Dept. of Physics	Fall 2020
Golden Key Scholar	2018
Phi Beta Kappa Scholar	2017
National Society of Collegiate Scholars	2015
Honda-OSU Math Medal Award	2014
Elks Foundation MVP Scholarship	2014
National Merit Scholar Finalist	2014

Teaching Experience

University of Colorado Boulder, Dept. of Physics, Boulder, CO

2018 – Present

Teaching Assistant (TA)

PHYS 1110 “General Physics 1” (Fall 2018)
PHYS 1120 “General Physics 2” (Spring 2019, 2024)
PHYS 1240 “Sound and Music” (Spring 2020; Fall 2020)
PHYS 4450/5450 “History and Philosophy of Physics” (Spring 2024)

Course Instructor

PHYS 1110 “General Physics 1” (Summer 2024)
PHYS 1230 “Light and Color” (Spring 2021)
PHYS 1240 “Sound and Music” (Summer 2019, 2020, 2021, 2022; Spring 2022, 2023; Fall 2023)
PHYS 1400 “Fundamentals of Scientific Inquiry” (Fall 2019, 2021)

Mentored Students

Devayani Ravuri, *Physics undergraduate, CU Boulder*

2023 – Present

Honors Thesis project: “Hawking radiation inside charged, cosmological black holes”

Krish Jhurani, *Homestead HS, Cupertino, CA*

2023

Independent research project: “Exploring time-like geodesics in asymptotically flat spacetimes”

Service & Community Outreach

Journal Peer-Reviewer

2022 – Present

Monthly Notices of the Royal Astronomical Society (MNRAS)
The European Physical Journal C (Particles and Fields)

Grand Canonical Ensemble, CU Boulder

2022 – 2024

Founded a physics community music ensemble involving weekly rehearsals and semesterly concerts under the dome at the Fiske Planetarium.

CU-Prime, CU Boulder

2019 – 2024

Student-led chapter of the national Access Network focused on education and DEI efforts in physics. I currently run a bi-weekly talk series and maintain the website and YouTube channel. I also co-taught the course developed and run by CU-Prime (PHYS 1400) twice.

Science Under the Dome Series: *Music of the Universe*, Fiske Planetarium, Boulder

2023

Presented an hour-long public show at the Fiske Planetarium on sound and astronomy.

Discovery Concert Series: *Soundsational Science*, Boulder, CO

2023

Collaborated with the Boulder Philharmonic Orchestra to design and teach in an educational concert program series for ~1,000 middle school students on the topic of the science of sound.

Physics & Astronomy Club, Case Western Reserve University

2014 – 2018

PR Chair for student-led club that promotes the interest of physics and astronomy to community through talks, trips, demo days, etc.

Center of Science and Industry (COSI), Columbus, OH

2012 – 2015

Experience Programs Teacher (2015), Floor Faculty Apprentice (2012-2014), Volunteer (2008-2012)
Performed science shows and demos, interacting with and educating museum guests. Volunteered for over 1500 hours before leading, teaching, scheduling, and mentoring new volunteers.