

# Tyler C. McMaken

Assistant Professor of Physics  
University of Mary, Bismarck, ND

## CURRICULUM VITAE

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## Education

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**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)

Minors in Astronomy, Mathematics

GPA: 4.0/4.0

**The Ohio State University, Columbus, OH** **2013 – 2014**

PSEOP (pre-baccalaureate program)

GPA: 4.0/4.0

## Research Experience

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**University of Colorado Boulder, Dept. of Physics, Boulder, CO** **2019 – 2024**

*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  $^{135}\text{Pr}$  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

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- McMaken, T.** (2024). “Backreaction from quantum fluxes at the Kerr inner horizon” *Phys. Rev. D*, 110, 045019. [↗](#)
- 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

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### 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”

*32<sup>nd</sup> 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  $^{135}\text{Pr}$ ”

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

## Media Mentions

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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

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**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**

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

## **Awards & Honors**

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<b>Dean's Innovation Fund Award</b> 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"	<b>2024</b>
<b>Gravity Research Foundation 2023 Awards for Essays on Gravitation</b> Honorable Mention <a href="#">🔗</a>	<b>2023</b>
<b>R. N. Thomas Award</b> JILA, CU Boulder, \$3,000	<b>2022</b>
<b>Physics Award for Outstanding Graduate Student Service (3x)</b> CU Boulder Dept. of Physics	<b>Spring 2024 &amp; Spring 2023 &amp; Fall 2021</b>
<b>Physics Award for TA Excellence</b> CU Boulder Dept. of Physics	<b>Fall 2020</b>
<b>Graduate Part Time Instructor Appreciation Award</b> CU Boulder Dept. of Physics	<b>Fall 2020</b>
<b>Golden Key Scholar</b>	<b>2018</b>
<b>Phi Beta Kappa Scholar</b>	<b>2017</b>
<b>National Society of Collegiate Scholars</b>	<b>2015</b>
<b>Honda-OSU Math Medal Award</b>	<b>2014</b>
<b>Elks Foundation MVP Scholarship</b>	<b>2014</b>
<b>National Merit Scholar Finalist</b>	<b>2014</b>

## Teaching Experience

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**University of Colorado Boulder, Dept. of Physics, Boulder, CO** **2018 – 2024**

### *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

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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

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**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.