Brandon Khek

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RESEARCH EXPERIENCE

Axions, topological defects, black hole perturbation theory, tidal Love numbers, particle cosmology, mathematical physics, high energy theory

EDUCATION

University of Pennsylvania Aug. 2023 – Present
M.S. (2024), Ph.D. in Physics (Expected 2028) *GPA: 4.00*
Supervised by Profs. Justin Khoury and Mark Trodden
Certificate in College and University Teaching (2025)

Rice University Aug. 2019 – May 2023
B.S. in Astrophysics, B.A. in Mathematics *GPA: 3.84*

PUBLICATIONS

* = preprint

1. V. De Luca, B. Khek, J. Khoury, & M. Trodden, (2026). Hidden symmetries for tidal Love numbers: generalities and applications to analogue black holes. *Physical Review D, to appear. arXiv/gr-qc: 2512.06082.*
2. V. De Luca, B. Khek, J. Khoury, & M. Trodden, (2025). Tidal Love numbers of analog black holes. *Physical Review D, 111 4, 044069.*
3. B. Khek, H.S. Grasshorn Gebhardt, & O. Doré, (2024). Fast Theoretical Predictions for Spherical Fourier Analysis of Large-Scale Structures. *Physical Review D, 110 6, 063524.*
4. B. Khek, A. Mishra, M. Buuck, & T. Shutt (2022). Gamma Ray Source Localization for Time Projection Chamber Telescopes Using Convolutional Neural Networks. *AI 2022, 3, 975-989.*

PRESENTATIONS

Patterns in the Tidal Love Numbers of Analog Black Holes Oct. 2025
COSMO-25 at CMU

Gamma Ray Source Localization for a Time Projection Chamber Telescope Using Convolutional Neural Networks Oct. 2022
Joint Fall 2022 Meeting of the Texas Sections of APS, AAPT and SPS Zone 13
Won best undergraduate poster presentation award.

Localizing Gamma Ray Sources with Machine Learning Jul. 2022
SLAC National Accelerator Laboratory
Presented work from the summer's research about leveraging machine learning to optimize the pointing capability of the proposed gamma ray observatory GammaTPC.

Calculation of Large Scale Structure Power Spectra in a Spherical Fourier Bessel Basis Oct. 2021
Joint Fall 2021 Meeting of the Texas Sections of APS, AAPT and SPS Zone 13
Won outstanding presentation award.

Calculation of Large Scale Structure Power Spectra in a Spherical Fourier Bessel Basis Oct. 2021
Gulf Coast Undergraduate Research Symposium
Won honorable mention presentation award.

Calculation of Large Scale Structure Power Spectra in a Spherical Fourier Bessel Basis Jul. 2021
Jet Propulsion Laboratory
Presented work from the summer's research about studying large scale structure through the matter power spectrum.

Gravitational Waves Resulting from Higgs Field Inhomogeneities Apr. 2021
Rice Undergraduate Research Symposium
Presented poster on work from fall 2020 research about gravitional wave emissions from the Higgs field. Placed in the top 10% of all presenters.

TEACHING EXPERIENCE

Founder and Mentor, Penn Physics DRP Jan. 2026 – Present
Created the UPenn Physics and Astronomy Directed Reading Program (DRP). Allocated funding for graduate student mentors, organized and presented academic informational events, solicited graduate and undergraduate applications and matched mentor-mentee pairs, mentored undergraduate students in high energy physics and cosmology.

Teaching Assistant Jan. 2025 – Present
Held weekly office hours and graded homeworks and exams, taught class when instructor was unavailable for General Relativity (S '25, '26) and Quantum Field Theory II (F '25).

Student-Taught Course Instructor Aug. 2021 – Dec. 2021
COLL 106: Dissecting Physics Pop Science
Designed a one-credit hour course, including but not limited to the syllabus, presentation material, homeworks, and assessments on the mathematics underlying physics popular science topics. Lead discussions, created and graded assignments, delivered lectures, and advised students on final projects. Mentored and delivered weekly lectures to a class of 9 students.

RCEL ELITE Tech Camp - Live Instructor Jun. 2020 – Aug. 2020
Taught 28 high school students the fundamentals of python programming and machine learning with regard to anomaly detection in meteorological data. Formulated lesson plans and curriculum with industry professionals and five other instructors for our course. Facilitated students' understanding of NumPy, SciKit-Learn, Pandas, MatPlotLib, and Pickle libraries.

OUTREACH

Penn STEM Outreach Aug. 2023 – Present
DEEPenn STEM Panel (2023) • **POPUP (Physics Outreach Program at UPenn** (2023) • **West Philadelphia HS** (2023-2024) • **Franklin Institute** (2023-Present)

Served on panel answering questions from underrepresented populations in STEM about graduate school • Presented physics demonstrations for elementary school students on campus, organized reading group on diversity and outreach in STEM • Created six physics labs with two other students and taught them at West Philadelphia High School and on campus • Presented physics demonstrations at the Franklin Institute's Science After Hours

Why Dark Matter is Not So Dark Jul. 2022
WDTS Ignite Off! Competition Winner at SLAC
Presented in the ORISE Ignite Off! competition – consisting of eye-catching and inspiring research presentations – about my work on the GammaTPC instrument and machine learning at SLAC. Moved on as a national finalist.

A Cosmological Perspective on Life Nov. 2021
TEDxRiceU
Presented to approximately 100 students, faculty, and alumni on the philosophical implications of various cosmological facts.

SEDS SpaceVision 2021 Nov. 2021
- Won bid for and planned the SEDS (Students for the Exploration and Development of Space) USA SpaceVision 2021 student-run space conference
- Coordinated the three-day conference at the JSC visitor center (NASA Space Center Houston) for 400 attendees composed of panels, workshops, competitions, and a career fair

McMurtry Residential College Aug. 2020 – May 2023
Academic Fellow (2021-2023) • **New Student Advisor** (2020-2021) • **Associate Justice** (2020-2021)
Selected as one of two math/physics academic fellows for our residential college and hosted weekly tutoring sessions, individual meetings, and review sessions • Advised nine students in the freshman class during their first year • Informed on student well-being policies through student government

Jet Propulsion Laboratory Winter Externship Jan. 2021
Selected as one of three Rice students to participate in an externship at JPL

Rice Splash - Introduction to Calculus Course Instructor Nov. 2020
Taught an online introductory calculus class to middle school students

HONORS AND AWARDS

Werner Teutsch Memorial Prize (Most outstanding 1st year, Penn P&A)	2024
Dessler Award (Best graduating astrophysics major, Rice Dept. of P&A)	2023
Heaps Prize (Outstanding work toward senior thesis, Rice Dept. of P&A)	2023
Distinction in Research in Physics and Astronomy (Rice Dept. of P&A)	2023
NSF Graduate Research Fellowship (NSF GRFP)	2023
Best Undergraduate Poster Award (Texas American Physical Society)	2022
WDTS Ignite Off! Competition Laboratory Winner (SLAC)	2022
SLAC Summer Undergraduate Laboratory Internship (Dept. of Energy)	2022
Bonner Book Award (Most outstanding physics sophomore, Rice Dept. of P&A)	2021
JPL Summer Undergraduate Research Fellowship	2021
Honorable Mention Award (Gulf Coast Undergraduate Research Symposium)	2021
Outstanding Presentation Award (Texas American Physical Society)	2021

Top 10% of Presenters (Rice Undergraduate Research Symposium)	2021
Colorado School of Mines Medal of Achievement in Math and Science	2019