Ryan Unger

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website

Education

Princeton University
Ph.D. in Mathematics (expected May 2024) — *2019 - ongoing*
Advisor: Mihalis Dafermos

University of Cambridge
Visiting Ph.D. student in Department of Pure Mathematics and Mathematical Statistics — *2022 - 2023*

University of Tennessee, Knoxville
B.S. in Mathematics, summa cum laude — *2015 - 2019*
Advisor: Alexandre Freire
Thesis: **Some problems in scalar curvature geometry**

Appointments

Stanford University
NSF Postdoctoral Fellow — *starting summer 2024*

University of California, Berkeley
Miller Fellow — *on leave until 2025*

Research interests

General relativity, nonlinear wave equations, and scalar curvature geometry.

Papers

8. Extremal black hole formation as a critical phenomenon 2024
with Christoph Kehle
arXiv:2402.10190.

7. Event horizon gluing and black hole formation in vacuum: the very slowly rotating case 2023
with Christoph Kehle
arXiv:2304.08455. Submitted.

6. Gravitational collapse to extremal black holes and the third law of black hole thermodynamics 2022
with Christoph Kehle
arXiv:2211.15742. To appear in *Journal of the European Mathematical Society (JEMS)*.

5. Noncompact fill-ins of Bartnik data 2022
with Dan A. Lee and Martin Lesourd
arXiv:2211.06280. To appear in *Journal of Geometric Analysis*.

4. Density and positive mass theorems for incomplete manifolds 2022
with Dan A. Lee and Martin Lesourd
Calc. Var. Partial Differential Equations **62** (2023).

3. Density and positive mass theorems for initial data sets with boundary 2021
with Dan A. Lee and Martin Lesourd
Commun. Math. Phys. **395**, 643–677 (2022).

2. The positive mass theorem with arbitrary ends 2021
with Martin Lesourd and Shing-Tung Yau
arXiv:2103.02744. To appear in *Journal of Differential Geometry.*

1. Positive scalar curvature on noncompact manifolds and the Liouville theorem 2020
with Martin Lesourd and Shing-Tung Yau
arXiv:2009.12618. To appear in *Communications in Geometry and Analysis.*

Undergraduate research:

0. Thermal signatures of Cu metal revealed through oxygen isotope fractionation 2020
with Jessica Bishop, Anthony Faiia, Anna Szynkiewicz, John Auxier II, Howard Hall, and Maik Lang
J. Radioanal. Nucl. Chem. **326**, 1653–1662 (2020)

Invited talks

UTK geometric analysis seminar	April 2024
Harvard BHI foundations seminar	March 2024
MIT strings/gravity seminar	February 2024
EPFL analysis seminar	February 2024
Columbia analysis seminar	November 2023
Cretan waves conference	October 2023
Virtual mathematical GR and hyperbolic PDE seminar	July 2023
University of Crete Center for Theoretical Physics	May 2023
Edinburgh analysis seminar	April 2023
Oxbridge PDE conference	March 2023
Rutgers hyperbolic and dispersive PDE seminar	February 2023
Berkeley analysis seminar	February 2023
Vanderbilt analysis seminar	February 2023
Harvard BHI colloquium	February 2023
Cambridge Friday GR seminar	January 2023
Zürich mathematical physics & PDE seminar	December 2022
Imperial College London junior analysis seminar	November 2022
YMNCGA Texas A&M	August 2022
Cambridge analysis student seminar	June 2022
Harvard CMSA workshop on scalar curvature and minimal surfaces	May 2022
Joint Mathematics Meeting special session on scalar curvature and convergence	April 2022
Princeton graduate student seminar	October 2021
Johns Hopkins analysis seminar	April 2021
Harvard CMSA general relativity seminar	April 2021
Princeton junior general relativity seminar	March 2021
Princeton graduate student seminar	October 2019

Teaching experience

Part II Differential Geometry supervisions	Lent 2023 (Cambridge)
Part III Analysis of PDEs examples class instructor	Michaelmas 2022 (Cambridge)
Part III General Relativity examples class instructor	Michaelmas 2022 (Cambridge)

Calculus I precept instructor — Spring 2022 (Princeton)
Teaching assistant for Calculus III, Linear Algebra, Real Analysis, PDE — (Princeton)

Awards and honors

NSF Postdoctoral Fellowship DMS 2401966 — 2024
Miller Fellowship, UC Berkeley Miller Institute for Basic Research in Science — 2024
Porter Ogden Jacobus Fellowship — 2023
– Princeton University's highest honor for graduate students in their final year
John H. Barrett Memorial Scholarship — 2019
– UTK Department of Mathematics' highest honor for undergraduates in their final year
James A. Cooley Memorial Scholarship — 2018
UTK Office of Undergraduate Research Grant — 2017
Pi Mu Epsilon Tennessee Delta Chapter — 2017
Cooper D. Schmitt Memorial Scholarship — 2017, 2018
Lucile and Herbert E. Lee Memorial Scholarship — 2017
UTK Nuclear Engineering Top Freshman Academic Award — 2016
Tennessee Volunteer Scholarship — 2015-2019

Service

Referee for:
Annales Henri Poincaré, Classical and Quantum Gravity, Mathematische Annalen, Transactions of the American Mathematical Society

Princeton Graduate Student Seminar Organizer — Fall 2020-Spring 2021
Princeton First Year Student Seminar Organizer — Fall 2019-Spring 2020

Miscellaneous

Languages: English (native), German (fluent)
Citizenship: USA