

# Ryan Unger

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USA

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website

## APPOINTMENTS

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### Stanford University

*NSF Postdoctoral Fellow*

*July 2024 - ongoing*

### University of California, Berkeley

*Miller Fellow*

*on leave until July 2025*

## EDUCATION

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### Princeton University

*Ph.D. in Mathematics*

*September 2019 - May 2024*

Advisor: Mihalis Dafermos

Thesis: **The extremal collapse threshold and the third law of black hole thermodynamics**

### University of Cambridge

*Visiting Ph.D. student in DPMMS*

*October 2022 - June 2023*

### University of Tennessee, Knoxville

*B.S. in Mathematics, summa cum laude*

*September 2015 - May 2019*

Advisor: Alexandre Freire

Thesis: **Some problems in scalar curvature geometry**

## RESEARCH INTERESTS

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General relativity, nonlinear wave equations, and geometric analysis.

## PAPERS

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### 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*

*Advances in Mathematics* **452** (2024).

### 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*

*J. Geom. Anal.* **34**:102 (2024).

- 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 Szyrkiewicz, John Auxier II, Howard Hall, and Maik Lang  
*J. Radioanal. Nucl. Chem.* **326**, 1653–1662 (2020)

## INVITED TALKS

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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

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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

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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

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Referee for:

*Annales Henri Poincaré, Classical and Quantum Gravity, Communications in Mathematical Physics, Communications on Pure and Applied Mathematics, 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

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Languages: English (native), German (fluent)

Citizenship: USA