

Curriculum Vitae  
**Richard Jude Anantua**

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## EDUCATION

- 2011-2016 **Stanford University**, Ph.D. Physics, Sep. 2016,  
Thesis: "Towards Multiwavelength Observations of Relativistic Jets from  
General Relativistic Magnetohydrodynamic Simulations,"  
Advisor: Roger Blandford, Ph.D., Sc.D., FRS
- 2013-2014 **Harvard University**, Ed.M. Education Policy and Management, May 2014,  
Cross-registered for courses at the Harvard-Smithsonian Center for  
Astrophysics and Harvard Business School
- 2011-2013 **Stanford University**, M.S. Physics, Jan. 2013
- 2006-2010 **Yale University**, B.S. (Physics and Philosophy) and (Economics and  
Mathematics), May 2010, Distinction in the (Physics and Philosophy) major

## ACADEMIC APPOINTMENTS

- HARVARD UNIVERSITY, CAMBRIDGE, MA
- Jan. 2019-2022 **Postdoctoral Fellow, Center for Astrophysics | Harvard & Smithsonian  
/Black Hole Initiative/Event Horizon Telescope**
- Conduct computational research at Institute for Theory and Computation
  - Conduct high-energy astrophysics research in Avi Loeb Group
  - Model jet/accretion flow/black hole emission for Theory and Simulations  
Working Group of the Event Horizon Telescope (EHT) Collaboration
- FLATIRON INSTITUTE, NEW YORK, NY
- Nov. 2020-Jan. 2021 **Visiting Scholar, Center for Computational Astrophysics**
- Conducted theoretical and computational research in high-energy  
astrophysics and dark matter phenomenology
- U.C. BERKELEY, BERKELEY, CA
- Nov. 2016-Jan. 2019 **Postdoctoral Fellow, U.C. Berkeley Department of Astronomy**
- Conducted high-energy astrophysics research on near-horizon emission  
modeling of accretion disks and outflows in Eliot Quataert Group
  - Advised and collaborated with graduate and undergraduate students

## MAJOR COLLABORATIONS

- Event Horizon Telescope (2020-)
  - Outreach Working Group Coordinator
- Fermi Large Area Telescope (2014-2016)

## EXPERIENCE

- U.C. BERKELEY, BERKELEY, CA
- Jul. 2018-Aug. 2018 **Instructor, U.C. Berkeley Department of Astronomy**

- Served as co-instructor for Astron 9 “Order of Magnitude Physics,” devising original PowerPoint lectures, problem sets, projects and exams
- Jul. 2017-Aug. 2017 **Instructor, U.C. Berkeley Department of Astronomy**
- Created Astron 9 “Relativity of Space and Time in Popular Science,” devising original PowerPoint lectures, problem sets, projects and exams
  - Served as Astron 9 Instructor of Record
- STANFORD UNIVERSITY, STANFORD, CA
- Sep. 2015-Dec. 2015 **Teaching Assistant, Stanford Department of Physics**
- Led discussion section, graded problem sets and worked on course design with Senior Staff Scientist Grzegorz Madejski in the graduate course Ph 216 Back of the Envelope Physics
- Apr. 2013-Jun. 2013 **Teaching Assistant, Stanford Department of Physics**
- Led discussion section, graded problem sets and guest lectured for Prof. Stefan Funk in the undergraduate course Ph 17 Black Holes
- Sep. 2012-Dec. 2012 **Teaching Assistant, Stanford Department of Physics**
- Led discussion section, graded problem sets and tutored students for Prof. Giorgio Gratta in the undergraduate course Ph 45 Light and Heat
- Jun. 2012-Aug. 2012 **GRE Coach, Stanford Humanities and Sciences Early Identification Program**
- Served as a math GRE coach for students of diverse backgrounds
  - Created all instructional material and homework
- SELF-EMPLOYED, NEW YORK CITY, NY
- Aug. 2010-May 2011 **Private Tutor**
- Advertised and performed tutoring services in chemistry, physics and math for middle and high school students in NYC
- YALE UNIVERSITY, NEW HAVEN, CT
- Sep. 2008-Apr. 2011 **Undergraduate Quantitative Reasoning Tutor**
- Tutored for Yale undergraduates in astronomy, economics, mathematics and physics courses
- May 2009-Aug. 2009 **Research Associate, Jack Harris Lab**
- Modeled using Python code an optomechanical cavity that strongly couples the oscillation of an SiN membrane to cavity electric field modes via radiation pressure in order to lay groundwork for quantum non-demolition measurement of membrane ground state phonon number
- Jun. 2008-Aug. 2008 **Researcher, Science, Technology and Research Scholars**
- Participated in a selective research and presentation program in which I created novel models of the graviton energy per frequency spectrum of Hawking radiating post-inflationary primordial black holes, a newly theorized source of stochastic gravitational wave background (confer Anantua et al., 2009)

## **FELLOWSHIPS, AWARDS & HONORS**

- Royal Astronomical Society – 2021 Group Achievement Award (Astronomy) (Awarded to the Event Horizon Telescope Collaboration)
- Harvard Future Faculty Leaders Fellowship (2018)
- Galaxies 2018 Volume 6 Issue 1 cover story (cf. Anantua et al., 2018)

<http://www.mdpi.com/2075-4434/6/1>

- Diversifying Academia, Recruiting Excellence (DARE) (2014) Fellowship awarded to ~20% of Stanford doctoral applicants for this fellowship
- Achievement Rewards for College Scientists (ARCS) (2013) (I declined this award to attend Harvard)
- Harvard University Leadership in Education Award (2013), awarded to top 10-15% of Harvard Graduate School of Education applicants
- Stanford University Humanities and Sciences Fellowship (2010)
- Yale College Dean's Research Fellowship (2009)
- AP Scholar with Distinction at Stuyvesant High School (2006) (the most selective NYC Specialized High School Admission Test school (~3% admission rate for Class of '06))
- Prep for Prep Les Pierre Medal (2001), awarded to 1 top male and 1 top female in >100-member cohort at the end of 14-month preparatory component

## PUBLICATIONS

17. R. M. Emami, **R. J. Anantua**, A. A. Chael and A. Loeb, "Modeling Positron Effects on Polarized Images and Spectra from Jet and Accretion Flow Models of M87 and Sgr A\*," [ArXiv [2101.05327](https://arxiv.org/abs/2101.05327)] submitted to ApJ (2021)
16. M. Janssen **et al.**, [Title Under Embargo], submitted to Nature Astronomy (2021)
15. **EHT Collaboration et al.**, [Title Under Embargo], submitted to PRD (2020)
14. R. Narayan **et al.**, "The Polarized Image of a Synchrotron-emitting Ring of Gas Orbiting a Black Hole," ApJ **912**, 35 (2021)
13. J. C. Algaba **et al.**, "Broadband Multi-Wavelength Properties of M87 During the 2017 Event Horizon Telescope Campaign," ApJL **911**, L11 (2021)
12. C. Goddi **et al.**, "Polarimetric Properties of Event Horizon Telescope Targets from ALMA," ApJL **910**, L14 (2021)
11. **EHT Collaboration et al.**, "First M87 Event Horizon Telescope Results. VIII., Magnetic Field Structure near The Event Horizon," ApJL **910**, L13 (2021)
10. **EHT Collaboration et al.**, "First M87 Event Horizon Telescope Results. VII. Polarization of the Ring," ApJL **910**, L12 (2021)
9. **R. J. Anantua**, R. M. Emami, A. Loeb and A. A. Chael, "Determining the Composition of Relativistic Jets from Polarization Maps," ApJ **896**, 30 (2020)
8. **R. J. Anantua**, S. M. Ressler and E. Quataert, "On the Comparison of AGN with GRMHD Simulations, I. Sgr A\*," MNRAS **493**, 1404 (2020)
7. T. K. Fowler, H. Li and **R. J. Anantua**, "A Quasi-Static Hyper-Resistive Model of Ultra High Energy Cosmic Ray Acceleration by Magnetically Collimated Jets Created by Active Galactic Nuclei," ApJ **885**, 4 (2019)
6. **R. J. Anantua**, R. D. Blandford and A. Tchekhovskoy, "Multiwavelength

- Observations of Relativistic Jets from General Relativistic Magnetohydrodynamic Simulations,” *Galaxies* **6**, 31 (2018)
5. R. D. Blandford and **R. J. Anantua**, “The Future of Black Hole Astrophysics in the LIGO-VIRGO-LPF Era,” *J. Phys.: Conf. Ser.* **840**, 012023 (2017)
  4. M. Ackermann **et al.** (Fermi-LAT Collaboration), “Minute-Timescale  $>100$  MeV Gamma-Ray Variability During the Giant Outburst of Quasar 3C 279 Observed by Fermi -LAT in 2015 June,” *ApJL* **824**, L20 (2016)
  3. **R. J. Anantua**, Sean A. Hartnoll, Victoria L. Martin and David M. Ramirez, “The Pauli Exclusion Principle at Strong Coupling: Holographic Matter and Momentum space,” *JHEP* **3**, 104 (2013)
  2. **R. J. Anantua** and O. K. Baker, “TeV Gamma Rays from Distant BL Lacs and Photon-Paraphoton Kinetic Mixing,” *Phys. Lett. B* **690**, 25-28 (2010)
  1. **R. J. Anantua**, R. Easther and J. T. Giblin Jr., “Grand Unification Scale Primordial Black Holes: Consequences and Constraints,” *Phys. Rev. Lett.* **103**, 111303 (2009)

#### PUBLICATIONS IN PREP

- **R. J. Anantua**, R. D. Blandford, A. Tchekhovskoy, A. A. Chael, R. M. Emami, A. Ricarte and A. Loeb, “On the Comparison of AGN with GRMHD Simulations, II. M87,” *MNRAS* (2021)
- **R. J. Anantua**, S. S. Alexander, D. Spergel and K. V. Tilberg, “Axion Couplings to the Kerr Metric as Sources of Positron Production,” *JHEP* (2021)
- **R. J. Anantua**, “Inductive Slowing of Relativistic Jets in GRMHD Simulations,” *ApJ* (2021)

#### PUBLICATIONS IN PRESS

- Harvard Crimson: “Harvard Astrophysicists Help Make Discovery in Understanding Black Hole’s Magnetic Fields,” (Apr. 2021), Retrieved Apr. 22, 2021 from: <https://www.thecrimson.com/article/2021/4/12/black-hole-polarization/>
- Gizmodo: “See a Black Hole’s Magnetic Fields in a New Image from the Event Horizon Telescope,” (Mar. 2021), Retrieved Apr. 22, 2021 from: <https://gizmodo.com/see-a-black-holes-magnetic-fields-in-new-image-from-the-1846542592?fbclid=IwAR3lmy77huJRZgWzci2boXjbW8o2kc0NN0e4Cu0wHarLd9GJbEzzS1eQXIY>
- American Astronomical Society: “Program Opens Research Pathways for Underrepresented Young Astrophysicists,” (Sep. 2020), Retrieved Apr. 22, 2021 from: <https://aas.org/posts/news/2020/09/program-opens-new-research-pathways-underrepresented-young-astrophysicists>
- Ivy Magazine: “Why Are We Here in the Universe?” (Feb. 2017), Retrieved May 7, 2017 from: <http://magazine.ivy.com/2017/02/why-are-we-here-in-the-universe/>

#### INVITED TALKS

- Astromeet2022 Copenhagen, Denmark (Jun. 2022)
- GRAPPA Amsterdam (Fall 2021)

- University of Virginia Colloquium (Fall 2021)
- University of Florida Special Colloquium on “Horizon-Scale Physics Using Movies and Polarization Maps” (Mar. 2021)
- Amherst College Colloquium on EHT M87\* Polarization Papers VII & VIII (Mar. 2021)
- Okanagan College talk on EHT M87\* Polarization Papers VII & VIII (Mar. 2021)
- Flatiron Institute Center for Computational Astrophysics, New York, NY, Galaxy Formation Group Meeting (Mar. 2021)
- University of Texas at Austin Physics Colloquium on “Horizon-Scale Physics Using Movies and Polarization Maps” (Mar. 2021)
- MIT Haystack talk on NSBP/SAO EHT Scholars initiative (Mar. 2021)
- Reed College Physics Seminar on “Horizon-Scale Physics Using Movies and Polarization Maps” (Feb. 2021)
- NASA Goddard Colloquium on “Horizon-Scale Physics Using Movies and Polarization Maps” (Jan. 2021)
- Cornell Astronomy Colloquium on “Horizon-Scale Physics Using Movies and Polarization Maps” (Dec. 2020)
- Flatiron Institute Center for Computational Astrophysics, New York, NY, Compact Objects Group Meeting (Dec. 2020)
- University of Illinois at Urbana-Champaign Astrophysics Colloquium on “Imaging and Beyond: Understanding Near-Horizon Physics. Using Movies and Polarization Maps” (Dec. 2020)
- SUNY Stony Brook Colloquium on “Imaging and Beyond” (Nov. 2020)
- SUNY Stony Brook Astro Open Night “Relativity of Space and Time in Popular Science” (Nov. 2020)
- University of Chicago Tuesday Lunch Seminar on “Towards Understanding Near-Horizon Physics of Sgr A\* from Movies and Polarization Maps” (Oct. 2020)
- Joint IAS/Princeton University Astrophysics Colloquium on “‘Observing’ JAB Simulations” (Aug. 2020)
- Brown Astrophysics Seminar Series, Providence, RI talk on “‘Observing’ JAB Simulations – Towards Understanding Jet/Accretion Flow/Black Hole Systems in Sgr A\* and M87” (Nov. 2019)
- “Understanding the Multiwavelength Blazar Variability – Workshop at Stanford” talk on cosmic ray acceleration in jets (Aug. 2019)
- Harvard Quasar Tea talk on “‘Observing’ JAB Simulations – Probing Near Horizon Scales in AGN” (Feb. 2019)
- Diversifying Academia Recruiting Excellence (DARE) 10<sup>th</sup> Reunion, Stanford, CA talk on “‘Observing’ JAB Simulations” (Nov. 2018)
- Harvard Black Hole Initiative talk on “‘Observing’ JAB Simulations” (Jun. 2018)
- City College of San Francisco talk on “Sgr A\* Emission Parametrizations from GRMHD Simulations” (Feb. 2018)

## SELECTED CONFERENCES

- Accreting Black Holes, Kathmandu, Nepal (Apr. 2022)
- American Astronomical Society 235<sup>th</sup> Meeting, Honolulu, HI talk on “Beyond Imaging: Probing Near-Horizon Physics from Movies and Polarization Maps based on GRMHD Simulations” (Jan. 2020)
- National Society of Black Physicists Conference, Providence, RI talk on “Discovering the Composition of Jets from Polarization Maps” (Nov. 2019)
- Tracing Cosmic Evolution with Clusters of Galaxies, Sexten, Italy poster on “Observing JAB Simulations— Probing Near Horizon Scales in Simulations” (Jul. 2019)
- 22<sup>nd</sup> International Conference on General Relativity and Gravitation, Valencia, Spain talk on “Observing JAB Simulations— Probing Near Horizon Scales in Simulations” (Jul. 2019)
- American Astronomical Society 234<sup>th</sup> Meeting, St. Louis, MO talk on “Cosmic Ray Acceleration in Jets by Accretion Disk Dynamo” (Jun. 2019)
- American Astronomical Society 233<sup>rd</sup> Meeting, Seattle, WA talk on “Observing JAB Simulations— Probing Near-Horizon Scales in Simulations” (Jan. 2019)
- American Astronomical Society 232<sup>nd</sup> Meeting, Denver, CO talk on “Observing JAB Simulations” (Jun. 2018)
- California Alliance Conference at U.C. Berkeley, poster presentation on “Observing Jet/Accretion Disk/Black Hole Simulations” (Mar. 2018)
- Polarized Emission from Astrophysical Jets, Ierapetra, Greece talk on “Observing Jet Simulations” (Jun. 2017)
- California Alliance Conference at UCLA, Los Angeles, CA poster presentation on “Observing Jet Simulations” (Feb. 2017)
- NSF Theoretical and Computational Astrophysical Network at U.C. Berkeley talk on “Observing Jet Simulations” (Jan. 2017)
- ASIAA M87 Workshop: Towards the 100<sup>th</sup> Anniversary of the Discovery of Cosmic Jets, Taipei, Taiwan oral presentation on “Observing Jet Simulations” (May 2016)
- American Astronomical Society 226<sup>th</sup> Meeting, Kissimmee, FL poster presentation on “Observing Jet Simulations” (Jan. 2016)
- California Alliance Conference at Caltech, Pasadena, CA poster presentation on “Observing Jet Simulations” (Apr. 2015)
- National Society of Black Physicists Conference, Baltimore, MD (Feb. 2015)
- Fermi Bubbles Theory and Observations Conference, Menlo Park, CA (SLAC) poster presentation on Parametric Modeling of Fermi Bubbles (Apr. 2013)
- American Physical Society Conference, Anaheim, CA oral presentation on (Anantua & Baker, 2010) (Apr. 2011)

## MENTORSHIP

- Fisk-Vanderbilt master's student Elon Price for master's thesis and Summer 2020 GRMHD project at Smithsonian Astrophysical Observatory (co-mentor: Christian Fromm)
- Undergraduate intern Nicholas Conroy for Summer 2020 EHT Outreach at Smithsonian Astrophysical Observatory (co-mentor: Shep Doeleman)
- U.C. Berkeley undergraduate Jeremy Wayland (2017-18), including Summer Undergraduate Research Fellowship (SURF) 2018

## OUTREACH & SERVICE

- Served as NASA FINESST grant reviewer Mar. 2021
- Started NSBP/SAO EHT Scholars Program, a paid summer internship at the Smithsonian Astronomical Observatory for undergraduate and graduate students affiliated with the National Society of Black Physicists
- Founded STEM Club, an organization uniting postdocs of color (PoC's) at Harvard through a monthly series of skill-building workshops and networking dinners starting March 2019
- Served on the American Astronomical Society Diversity and Inclusion Task Force – Data Collection and Metrics for Success Working Group, contributing to the 2018 Final Report:  
[https://aas.org/files/aas\\_diversity\\_and\\_inclusion\\_task\\_force\\_final\\_report.pdf](https://aas.org/files/aas_diversity_and_inclusion_task_force_final_report.pdf)

## SKILLS

- *C++*, *Mathematica*, *Matlab*, *Python*, *R*, *STATA*, *UNIX*
- National Strength and Conditioning Association: Certified Personal Trainer (2011)
- Five years of formal instruction in Latin; conversational in French and Haitian Creole

## ACTIVITIES

- Jun. 2000-Present **Prep for Prep**, NEW YORK, NY  
A highly selective leadership development program that incorporates a rigorous 14-month academic component to prepare students for placement in leading independent schools and continues to work closely with the students through high school graduation and beyond
- Sep. 2008-Dec. 2011 **Powerlifting**  
Trained for powerlifting competitions, best squat/bench/deadlift (lbs.) 358/309/573 (in competition, 220lbs. class, raw, no wraps), 365/350/600 (in training at ~210lbs., raw, no wraps, lifetime drug-free)
- Oct. 2007-May 2010 **Klib Kreyòl (Haitian Students Alliance)**  
Served as vice president, publicizing club history, visiting Haiti for outreach, and coordinating alumni-student events
- Sep. 2006-Sep. 2009 **Yale Rugby**  
Played flanker, center