David Grabovsky

Curriculum Vitæ

Department of Physics • 6118 Broida Hall • UC Santa Barbara • CA 93106

✉ davidgrabovsky@physics.ucsb.edu ☎ (215) 285–0329

⌂ https://web.physics.ucsb.edu/~davidgrabovsky/

Research interests: semiclassical quantum gravity in AdS_3/CFT_2 and the conformal bootstrap

EDUCATION

University of California, Santa Barbara (UCSB) *Sep. 2019 – present*

Ph.D. Candidate, Physics (fourth year). GPA: 3.88/4.00

- Thesis topic: semiclassical methods in AdS_3/CFT_2
- Advisor: Professor David Berenstein

Columbia University in the City of New York (CU) *Sep. 2015 – May 2019*

B.A. in Physics; B.A. in Mathematics. GPA: 3.78/4.00; Dean's List

- Thesis: "The Limits of the Hubbard Model"
- Advisor: Professor Sebastian Will

Lower Moreland High School *Sep. 2012 – Jun. 2015*

Valedictorian and National Merit Finalist

RESEARCH EXPERIENCE

Gravity and high energy theory (HET) *Apr. 2020 – present*

Berenstein group, UCSB

- Working on constructing replica-symmetry-breaking saddles in 3D gravity, with applications to entanglement entropy, black hole thermodynamics, and wormholes in AdS/CFT.
- Studied the dynamics of light probe fields in the background geometry of a heavy object in AdS_3, finding agreement between bulk and boundary methods and gaining a novel understanding of the Hawking–Page transition and the emergence of thermality in AdS/CFT.
- Investigating extensions of this work in higher dimensions and including quantum corrections.
- Posed and resolved a puzzle in AdS/CFT where a null trajectory in the bulk appears to violate boundary causality. Causality is saved by the nonlocality of holographic bulk encoding.
- Conducted extensive literature review in holography, quantum gravity, and related fields.

Previous work in experimental physics *Jun. 2014 – May 2019*

- **AMO** (Will Lab at Columbia, `will-lab.com`):

    - Wrote a BA thesis investigating theoretical aspects of the Hubbard model.
    - Studied Bose-Einstein condensates (BECs) of molecular (NaCs) dipolar quantum gases.
    - Wrote image-processing code in Python and interfaced with a CCD camera to produce laser absorption images of BECs and determine their temperature and density.
    - Designed a Zeeman slower by simulating and optimizing atomic cooling in Python.
    - Built and calibrated PID-controlled single-mode lasers and aligned laser spectroscopy cells.

- **CMX** (Pasupathy group at Columbia, `anp-lab.physics.columbia.edu`): Designed various components for an atomic force microscope (AFM) with CAD software and assembled them using machine tools; determined the Q-factor of quartz resonators used as AFM scan tips; and helped build a vacuum transport system for molecular samples.

- **HEX** (Instrumentation Division at Penn): Detected cosmic-ray muons using drift tubes with a team during the QuarkNet summer program, and interned in Penn's instrumentation group.

PUBLICATIONS

- D. Berenstein and **D. Grabovsky**, "The Tortoise and the Hare: A Causality Puzzle in AdS/CFT," Class. Quant. Grav. **38**, no.10, 105008 (2021) [arXiv:2011.08934 [hep-th]].
- D. Berenstein, **D. Grabovsky**, and Z. Li, "Aspects of Holography in Conical AdS_3," [arXiv:2205.02256 [hep-th]].

TALKS AND SEMINARS

Conferences and Meetings

- "Holography in Conical AdS_3," 11th Annual UCSB *Oct. 2021*
  Worster Symposium (presented virtually by Ziyi Li)

- "The Tortoise and the Hare: A Causality Puzzle in AdS/CFT," *Mar. 2021*
  37th Annual Pacific Coast Gravity Meeting (virtual)

Other Talks and Seminars *Jul. 2017 – present*

- **Group meeting and journal club talks** on various topics, including: the Schwinger–Keldysh formalism; Chern–Simons theory; Wilsonian renormalization; covariant phase space; 2D CFT and the conformal bootstrap; entanglement entropy in 2D CFT; the Narain lattice; moduli of Riemann surfaces; elliptic functions and Abelian integrals; monodromy problems; and more.
- **Talks given to undergraduates** at meetings of the Society of Physics Students (SPS) and the Undergraduate Mathematics Society at Columbia on various topics, including: representations of the symmetric group; Galois cohomology and the Mordell–Weil theorem; the physics of the Hubbard model; radiation reaction and self-force in electromagnetism; and more.

Teaching and Mentorship

Teaching Associateship *Jun. 2022 – Jul. 2022*

- Taught PHYS 103, an upper-division course on Newtonian mechanics and special relativity.
- Prepared and delivered lectures; wrote assignments, exams, and solutions; held office hours; managed course websites; and led a teaching team in administering the course.

Teaching Assistantship *Sep. 2019 – present*

- Led discussion sections emphasizing active learning, held engaging office hours, advised undergraduate Learning Assistants, graded homework and exams, wrote assignment solutions, prepared review materials and sessions, managed course websites, and met with teaching teams.
- Acted as the teaching assistant for both lower-division and upper-division courses, including

  - PHYS 23 (electrostatics),
  - PHYS 25 (modern physics),
  - PHYS 104 (advanced mechanics),
  - PHYS 115A (quantum mechanics I)
  - PHYS 115C (quantum mechanics III)
  - PHYS 119A (thermodynamics).

- Acted as the teaching assistant for CS 31–36, a two-year honors sequence covering Newtonian and Lagrangian mechanics, indices and tensors, thermodynamics, fluid dynamics, elasticity, special relativity, electromagnetism, waves and optics, and some quantum mechanics.

Mentorship and Advising (UCSB) *Jun. 2020 – present*

- Graduate member of Undergraduate Diversity and Inclusion in Physics (UDIP).
- Graduate member of Physics Circus, an organization that brings weekly physics demonstrations to local elementary schools to spread physics to younger and more diverse audiences.
- Mentored three undergraduates through UDIP, advising them on classes, resume writing, grad school applications, and research opportunities; and introduced them to advanced topics.

Teaching and Tutoring (Columbia) *Oct. 2015 – May 2019*

- Taught semesterly classes in math and physics to high school students through Columbia's Splash program. Topics: Hamiltonian mechanics, quantum physics, linear algebra, groups and representations, Gödel's incompleteness theorem, and the Banach–Tarski paradox.
- Organized and led educational physics demonstrations for middle school students with SPS.
- Volunteered to tutor undergraduate students in linear algebra in Columbia's math help room.
- Tutored high school and undergraduate students in math and physics through Chegg.

Honors, Awards, and Leadership

- Awarded the UCSB Physics Department's 2022 Physics Circus and Outstanding TA Awards.
- Nominated for the UCSB Academic Senate's 2019 and 2022 Outstanding TA Awards.
- Awarded the 2021 Worster Summer Fellowship for work with David Berenstein and Ziyi Li.
- Nominated for the UCSB Graduate Student Association's 2020 Excellence in Teaching Award.
- Awarded summer fellowship funding from CU's Center for Career Education, through the Alumni & Parent Internship Fund and the Work Exemption Program (2016–2018).
- President and webmaster of the Columbia University Society of Physics Students (SPS).

Graduate Coursework

University of California, Santa Barbara (UCSB) *Sep. 2019 – present*

- *Teaching Theory into Practice* (Profs. Berry and Kuntzman)
- *Statistical Mechanics* (Prof. Marchetti)
- *Many-Body Theory* (Prof. Vijay)
- *Quantum Field Theory I–III* (Profs. Srednicki, Giddings, Craig)
- *Gauge Theories I–II* (Profs. Craig and Berenstein)
- *General Relativity I–II* (Profs. Horowitz and Berenstein)
- *String Theory I–II* (Profs. Morrison and Marolf)
- *AdS/CFT and Gravitational Holography* (Prof. Dong)
- *Gravitational Path Integrals* (Prof. Marolf)
- *Ricci Flow and Einstein Manifolds* (Prof. Ye)

Columbia University in the City of New York (CU) *Jan. 2018 – Dec. 2018*

- *Quantum Field Theory I–II* (Prof. Denef)
- *Modern Geometry* (Prof. Liu)

ADDITIONAL SKILLS

Programming: proficient in Python (numpy and scipy), Mathematica, LaTeX, and Microsoft Office; competent in MATLAB and HTML/CSS.

Languages: native fluency in English and Russian.

Music: hobbies in classical piano and voice (20+ years).