

BARKOTEL FESSEHA ZEMENU

[linkedin.com/in/barkotelzemenu](https://www.linkedin.com/in/barkotelzemenu)

barkotel.zemenu@yale.edu

+1-202-459-1533

EDUCATION

Stanford University | PhD Physics

Sep 2024 – June 2030 (expected)

Knight-Hennessy Scholar

Stanford, CA

Yale University | BS Physics (Intensive)

Aug 2020 – May 2024

Summa Cum Laude | Phi Beta Kappa | Distinction in Physics (Int.)

New Haven, CT

RESEARCH EXPERIENCE

Particle Astrophysics: Dark Matter Radio (DMRadio)

Sep 2023 - Present

Prof. Kent Irwin | Stanford University

Stanford, CA

- Designed theoretical constraints for optimizing resonator-amplifier coupling in dark matter detection systems
- Built and tested a tunable transformer to optimize resonator-amplifier coupling efficiency

Astrophysics: Large Array Survey Telescope (LAST) Observatory

June 2023 - Aug 2023

Prof. Eran Ofek | Weizmann Institute of Science (Kupcinet-Getz International Summer School)

Rehovot, Israel

- Investigated stellar variability using the Large Array Survey Telescope (LAST) by operating 32 telescopes at the Israeli Negev Desert and developing the observatory's data reduction pipeline
- Created a novel algorithm that automates the detection of variable stars from a given LAST image by generating a detailed photometric report as described in this pre-print: [arXiv:2309.01014](https://arxiv.org/abs/2309.01014)
- Improved essential data workflow to identify intermediate polars (accreting white dwarfs) with very short periodicity (<10 min)

Quantum Gravity: Entangling Quanta of Spacetime as Spin Networks

Jul 2022 - Aug 2022

Dr. Daniele Oriti | Ludwig Maximilian University of Munich (MCQST)

Munich, Germany

- Compiled a whitepaper on the group field theory formalism of quantum gravity, focusing on the entanglement entropy of spin networks
- Applied quantum information tools to tensorial group field theories to explore the emergence of spacetime from the entanglement of spin networks with arbitrary connectivity

High Energy Physics: nEXO Experiment

Jan 2021 - May 2024

Prof. David C. Moore | Yale University (Wright Lab)

New Haven, CT

- Led outgassing measurements at Yale for nEXO, an upcoming experiment searching for neutrinoless double beta decay
- Created a program in Python to model the outgassing of electronegative impurities from candidate detector materials in nEXO
- Introduced major upgrades to the outgassing vacuum chamber at Yale, reducing the systematic error in measurements by an order of magnitude
- Compiled the standard operating procedure for undertaking outgassing measurements at Yale, reducing data taking time from 2.5 hours to 1 hour

SKILLS

Programming & Computing: Python, MATLAB, Mathematica, C++, R, Visual Studio, Jupyter Notebook

Laboratory Skills: R&D instrumentation, vacuum systems, telescope observation, data analysis & acquisition

Document Creation: \LaTeX , Markdown, Microsoft Office Suite

Languages: Amharic (*Native*) | English (*Bilingual*) | Hebrew (*Professional Working*) | Mandarin Chinese (*Limited Working*) | Ancient Greek (*Limited Working*) | French (*Elementary*) | Arabic (*Elementary*)

SELECT HONORS AND AWARDS

Knight-Hennessy Scholar 1 of 90 Stanford graduate students selected from 8,272 applicants on the basis of "independence of thought, purposeful leadership, and civic mindset"	May 2024 Stanford
Invited to 73rd Lindau Nobel Laureate Meeting in Physics 1 of 650+ invitees selected from 90+ nations to join 30+ Physics Nobel Laureates at "one of the most prestigious STEM meetings in the world for students and early career scientists"	May 2024 International
Outstanding Undergraduate Achievement Award Awarded to "a group of seniors for distinguishing themselves ... through the maintenance of the highest levels of academic performance and extracurricular accomplishments"	April 2024 Yale
Daniel Siegel Award — Grace Hopper Residential College "For that student who exemplifies a love of learning, a spirit of integrity, and a commitment to kindness and who embodies these traits in a humble and quiet manner"	April 2024 Yale
James Mills Peirce Fellowship — Harvard University Awarded to "a select group of the most talented prospective PhD students in the natural sciences and engineering" [offered to 5/53 Harvard Physics admits] (Declined)	February 2024 Harvard
President's Fellowship — Princeton University Awarded to " less than 10% of admitted students in recognition of distinguished work and academic promise in the field of Physics" (Declined)	February 2024 Princeton
Presidential Graduate Fellowship — California Institute of Technology Awarded to the top 10 of Caltech's "most promising young scholars from the disciplines" to provide "a lot of flexibility to focus on research without needing to TA or RA" (Declined)	February 2024 Caltech
Sigma Pi Sigma Leadership Scholarship Awarded based on "examples of Honor, Encouragement, Service, and Fellowship; ... continued scholastic development in physics; and active participation in Sigma Pi Sigma programs"	December 2023 National
Phi Beta Kappa Senior Inductee Elected to the "oldest academic honor society in the United States, and the most prestigious , due in part to its long history and academic selectivity"	October 2023 National
Jocelyn Bell Burnell Outstanding Leadership Scholarship (\$6,000) \$6,000 annually awarded to one student in the nation by American Institute of Physics "for demonstrating academic excellence and leadership"	May 2023 National
Sigma Pi Sigma ($\Sigma\Pi\Sigma$) Junior Inductee Elected to the oldest and only American honor society for physics and astronomy of " distinctive achievement and high scholarship in physics"	May 2023 National
Top Oral Presenter at APS (American Physical Society) April 2023 Meeting Awarded to " top presenters excelling in preparedness, visual layout, understanding of concepts, answering questions, presentation organization, and logic/flow"	April 2023 International
Summer Research Award at Weizmann Institute of Science (\$3,000) The Alec Ellison '84 and Tamar Sadeh '85 Israel Travel Fund provides a competitive stipend to undergraduate students carrying out a [summer] experience in Israel	April 2023 Yale

STARS II Research Fellowship (\$8,000)	January 2023
<i>Highly selective</i> program and only undergraduate Yale fellowship awarding academic-year research stipend of \$4,000 and conference travel award of \$4,000 for a select few juniors and seniors	
Finalist: PhysCon22 Poster Competition	September 2022
Top 10% poster presentation <i>finalist</i> presenting at "the <i>largest</i> known gathering of undergraduate physics students in the US [\sim 1,200 attendees]"	
CEU: Conference Experience for Undergraduates Award (\$700)	August 2022
<i>Nationally competitive</i> conference award for <i>APS DNP 2022</i> based on the " <i>high quality</i> of submitted research abstract and personal contribution to the research group effort"	
Yale Rosenfeld Science Scholarship (\$8,500)	March 2022
Awarded to <i>top 10%</i> of Yale undergraduate STEM researchers who have "demonstrated <i>exceptional</i> potential and commitment through their coursework and research experience"	
Highest Grade in Quantum Mechanics I (PHYS 440)	May 2022
Top performance in a class of 50 praised in a special <i>End-of-Term Report</i> submitted for "students who do truly <i>exceptional</i> work and by all accounts actually deserve an A+"	
Yale College First-Year Summer Science & Engineering Research Fellowship (\$4,300)	April 2021
\$4,300 summer fellowship stipend <i>competitively awarded</i> for 10 weeks of intensive summer research on neutrino physics at Yale's Wright Laboratory	
Top 0.01% National Exam Scorer	March 2021
Scored in the 99.99th percentile (337,858 test takers) on the Ethiopian high school leaving exam; atypically taken during freshman year at Yale college due to pandemic disruptions	

SELECT PRESENTATIONS AND PUBLICATIONS

Noise Optimization in DMRadio-50L Using a Tunable Transformer <i>UCLA Dark Matter</i>	March 25, 2025 Los Angeles, CA
Developing an Outgassing Model for Candidate Detector Materials in nEXO <i>APS Division of Nuclear Physics (DNP) 2023 Meeting</i>	November 28, 2023 Waikola, HI
Searching for Variable Stars Using the Large Array Survey Telescope <i>Weizmann Institute of Science Summer Symposium arXiv:2309.01014</i>	August 6, 2023 Rehovot, Israel
Characterizing the Outgassing of Electronegative Impurities in nEXO <i>APS April 2023 Meeting Junior Thesis Report</i>	April 15, 2023 Minneapolis, MN
Quantum Gravity: Emergence of Spacetime from Entangling Tetrahedra <i>Yale Undergraduate Research Symposium 2022 Whitepaper Preprint</i>	November 12, 2022 New Haven, CT
Measurement of Outgassing Properties for Potential nEXO Materials <i>APS Division of Nuclear Physics (DNP) 2022 Meeting</i>	October 28, 2022 New Orleans, LA
Outgassing Measurements for Candidate nEXO Materials <i>Society of Physics Congress 2022 (PhysCon22)</i>	October 8, 2022 Washington D.C.

nEXO: In Search of No Neutrinos <i>Yale Rosenfeld Research Symposium</i>	October 6, 2022 New Haven, CT
Report on Outgassing Properties Analysis for nEXO plastics <i>nEXO R&D Meeting</i>	August 29, 2022 New Haven, CT
Entangling Quanta of Spacetime in Quantum Gravity Models <i>Munich Center for Quantum Science and Technology</i>	August 26, 2022 Munich, Germany
Towards Accurate Diffusion Coefficients for nEXO Detector Materials <i>Yale Undergraduate Research Symposium 2021</i>	November 6, 2021 New Haven, CT
On the Search for Neutrinoless Double-Beta Decay <i>Wright Laboratory Summer Symposium</i>	July 27, 2021 New Haven, CT

SELECTIVE SUMMER PROGRAMS

Kupcinet-Getz International Summer School (7% acceptance rate) Weizmann Institute of Science summer program which "accepts a select number of outstanding undergraduate students [17/250] each summer to participate in research projects"	March 2023 Rehovot, Israel
PSI START Online Summer School (8% acceptance rate) Perimeter Institute 10-week online summer school offering "[40/500] successful applicants ... four courses on modern topics in theoretical physics"	February 2023 Ontario, Canada
MCQST Summer Bachelor Program (5% acceptance rate) Munich Center for Quantum Science and Technology (MCQST) research internship for "[17/300] international Bachelor students selected ... through a highly competitive process "	May 2022 Munich, Germany
CERN Summer Student Programme (4% acceptance rate) — Declined¹ CERN summer studentship for approximately 150/4000 selected applicants	April 2023 Geneva, Switzerland
Lee Teng Fermilab Internship (top 10 applicants) — Declined¹ Fermilab-Argonne competitive paid internship for the top 10 applicants	March 2023 Batavia, IL
EPFL Summer Internship (10% acceptance rate) — Declined¹ Excellence Research Internship Program (ERIP) at EPFL for top 10% of applicants	December 2022 Lausanne, Switzerland

TEACHING EXPERIENCE

Teaching Assistant: Intensive Introductory Physics II (PHYS 261) Advanced introductory course on electromagnetism and quantum physics, information & computation	Spring 2024
Teaching Assistant: Intensive Introductory Physics I (PHYS 260) Advanced introductory course on classical mechanics, relativistic mechanics and gravitation	Fall 2023
Teaching Assistant: Fundamentals of Physics II (PHYS 201) Upper-intermediate introductory course on electromagnetism, optics and quantum mechanics	Spring 2023
Teaching Assistant: Fundamentals of Physics I (PHYS 200) Upper-intermediate introductory course on Newtonian mechanics, gravitation and thermodynamics	Fall 2022

¹Declined due to visa/international student employment complications

Instructor and Mentor: Yale Young Global Scholars (YYGS)	Summer 2022
Coached a highly selective international summer academic program for high school students	
Teaching Assistant: Electromagnetism for the Life Sciences (PHYS 171)	Spring 2022
Lower-intermediate introductory course on waves, optics and electromagnetism tailored for premeds	
Teaching Assistant: University Physics I (PHYS 180)	Fall 2021
Lower-intermediate introductory course on kinematics, dynamics, planetary motion and oscillations	
Grader: Multivariable Calculus (MATH 120)	Fall 2021
Graded weekly problem sets for Yale's highest-level calculus course sequence	
Pre-Calculus Instructor: Online Experience for Yale Students (ONEXYS)	Summer 2021
Coached incoming Yale first-years preparing for Yale's calculus sequence	

COMMUNITY INVOLVEMENT

Co-President: Yale Society of Physics Students (SPS) Jan 2023 - Jan 2024

Spearhead a board of 10 members, oversee 10+ year-long projects and provide programmatic and technical leadership, meet with department administrators and SPS faculty advisor to implement department-wide initiatives

- Led the club to achieving the national [Outstanding SPS Chapter](#) title, awarded to less than 10% of over 800 SPS chapters across the nation
- Drafted and compiled the award-winning [Chapter Report](#) detailing all of Yale SPS's accomplishments during my tenure

Outreach Co-Chair: Yale Society of Physics Students Sep 2021 - Jan 2023

Build connections with local schools and existing outreach organizations to gauge interest and understand what SPS can provide for younger students, the New Haven community as well as the Yale undergraduate community
 Launched brand-new outreach efforts such as the bi-annual "Physics Of..." series, biweekly "Dinners with Professors", weekly "Phun PSET nights", semester-long Peer Mentorship programs, and several more that revitalized the SPS community post-COVID

Adopt-a-Physicist: Sigma Pi Sigma Honor Society Oct 2023 - Present

"Adopt-a-Physicist connects high school physics students to real physics graduates who are eager to share their stories... Many students are under the mistaken impression that science is far removed from everyday life and not practical. This misconception can be an incredible barrier to entering a career in the field. [By sharing your story and your work](#), you have helped to demonstrate how interesting and important a degree in physics and astronomy can be. You have made a difference in these students' lives!"

I was "adopted" by three middle- and high-schools across the world (Romania, Minnesota and Texas); I interacted with students on a nearly daily basis, answering their multitude of curiosity-filled questions and allowing them to share their own interests and aspirations

Course Instructor: Yale Splash and Rainstorm Sep 2021 - Present

Teach lecture-based or seminar-style classes to high school and middle school students on a range of topics (eg. [Let's Tour the Invisible! An Adventure in Particle Physics](#); [The Meaning of Life](#))

Splash allowed me to freely explore profound topics, challenge assumptions, and foster genuine introspection with my students. Unconstrained by traditional syllabi or prerequisites, it provided me the space to bring tangible, real-life impact on my students' perspectives and understanding.

Contributor to *Accent*: Yale's Multilingual Undergraduate Publication

Feb 2022 - Present

Accent is Yale's only multilingual publication exploring diverse worldviews with a multicultural lens in over 10 languages.

I published my very first Hebrew piece (a 250 word poem: "Love or Money?") before the end of my first Hebrew semester. My most recent publication was a short story: "The Miracle of Everyday Life." I'm working to publish a Mandarin Chinese prose (Spring '24) and an Ancient Greek poem (Fall '24)

Co-Leader: Yale Sustainable Laundry Initiative

Fall 2023 - present

A student-led initiative focused on reducing personal carbon emissions by promoting eco-friendly laundry habits on the Yale campus.

Contributed to the development and distribution of educational flyers advocating for cold-water washing, potentially reducing individual CO2 emissions by over 800 pounds annually—equivalent to planting of an acre of forest. Successfully obtained permission to display these materials in laundry rooms across Yale's residential dormitories, significantly enhancing student awareness and driving sustainable practices

Physics Undergraduate Student Advisory Committee (UGSAC)

Sep 2020 - May 2023

UGSAC members serve as a point of communication between undergraduate students interested in the physics major and department leadership

- Among a select group of nominated students tasked with enhancing the academic and community experience within the Physics Department
- Collaborated with faculty and administration to provide strategic student insights and recommendations aimed at curriculum improvements and departmental policy changes.
- Organized and led discussions that bridged student concerns with faculty, fostering a more engaging and supportive educational environment.

Residential Assistant: Yale Summer Session (YSS)

Summer 2022

1 of 9 RAs selected to support Yale Summer Session (YSS) staff as "mature students who enjoy working with others and who feel committed to the intellectual and social values of residential college life"

Note Taker for Quantum Mechanics I (PHYS 440)

Spring 2022

Provided high-quality notes from beginning to end of semester to the Resource Office on Disabilities, intended for students in need of accommodations

Yale Education Teaching Initiative (YETI) Volunteer

Spring 2021

Offered academic assistance to New Haven middle-schoolers affected by the pandemic