Welcome back!

RESPASSING

First Physics Club Academic Year 2021-2022

Karsten Heeger, Chair





May 2021

ITACHI

100

Physics in 2020





Manoa Andriamirado

John Koblanski



ics in 2021



Yale Physics Department



Reconnecting and rebuilding our community

Yale Physics

Return to Campus - An Outlook



Accomplishments in 2020-2021

Institutes and New Spaces

Science Initiatives

Strategic Planning



Welcome to New Faculty



Ian Moult Assistant Professor of Physics

Particle Theory

Jet Substructure: Peeking inside jets for clues!



https://www-theory.lbl.gov/~ianmoult/



Jet Substructure:

Identify microscopic interactions using macroscopic energy flow

6



 $\mathcal{E}(\vec{n}_1)$

Welcome to 2021 Mossman Fellow



Justin Lane

Ph.D. in Physics, 2021 (MSU)

Background:

- Main work: studying interaction of superconducting quantum circuits with superfluid helium and surface acoustic waves (SAWs)
- Earlier work: studying interaction of SAWs with two dimensional electron systems (graphene)

Main project at Yale:

- "Membrane-in-the-middle" cavity optomechanics
- Non-hermitian dynamics near higher-order exceptional points

https://physics.yale.edu/yale-mossman



Welcome to the 2021 Graduate Students



Braedyn Au (University of Calgary), Maria Eduareda Belota Moreno (Amherst College), Naomi Brandt (Mount Holyoke College), Sara Butler (Bucknell University), Kangle Cai (Nanjing University), David Carcamo (Johns Hopkins University), Katie Chang (University of Virginia), Harper Cho (NYU-Abu Dhabi), Evan Craft (Dartmouth College), Allison Culbert (Tufts University), Isaque Dutra (MIT), Naomi Gluck (SUNY, Stony Brook), Eleanor Graham (MIT), Songtao Huang (Nanjing University), Rohin McIntosh (Princeton University), Toni Montalva (UC-Riverside), David Nguyen (University of Southern California), Xiaowei Ou (University of Science and Technology of China), Yale *Physics*

Welcome to the 2021 Graduate Students



Xiaoyi Ouyang (Peking University), Joy Pajarla (Lewis and Clark College), Gregory Penn (Temple University), Mengwen Shi (University of Maryland, College Park), Cassady Smith (Whittier College), Sylvi Stoller (SUNY, Stony Brook), David Su (UCLA), Andrew Tamis (Pennsylvania State University), Yarone Tokayer (Columbia University), Yu-Han Tseng (National Taiwan University), Mira Varma (University of Connecticut), Molly Watts (Columbia University), Sierra Weyhmiller (University of Notre Dame), Angela White (Brown University), Sven Witthaus (UC-Santa Barbara), Lihao Yan (University of Notre Dame)





Yale Physics Graduate Program

People

faculty (primary) 35 faculty (secondary) 24 grad students (physics only) 132

Median time to graduation 6.2 yrs

Diverse interests interdisciplinary opportunities

applied physics astronomy/astrophysics biological physics/systems biology materials science

Recent Alumni



https://physics.yale.edu/people/alumni



Our Graduate & Undergraduate Program Teams

Graduate Program



Stacey Watts Graduate Registrar



Rona Ramos Graduate Program Coordinator



Bonnie Fleming DGS

Undergraduate Program



Daphne Klemme Undergraduate Registrar



Nikhil Padmanabhan DUS



https://physics.yale.edu/about/committees-officers

Welcome to New Staff!

Operations Manager



Chair's Assistant



Candy-Ann Francis

Vanessa Wooley

Administrative Staff



Taylor Dunningham



Yale Physics Staff Anniversaries









Paul Noel	5 Vaara		
Instructional Support Specialist	J rears		
Geriana Van Atta	5 Veere		
Senior Administrative Assistant	J fears		
Victoria Misenti			
Program Manager			
Cindy Conforte	20 years		
Financial Assistant			



Yale Physics Staff Anniversaries



STEPHEN IRONS

Manager of Instructional Labs, Lecturer in Physics

Rona Ramos

Graduate Services Coordinator, Lecturer in Physics

KIMBERLY TIGHE Senior Administrative Assistant

LILLIAN VINSTON Administrative Associate Retiring in July (19 Years)

20 Years

20 Years

20 Years





Statement of Principles

Respect

We continually strive to make our department a place that respects people with **diverse** backgrounds and values each others' **creativity**.

Well-being

We commit to actively engage in creating a **supportive** and **safe environment**. Criticism and praise are professional and constructive.

Integrity

We carry out our work with **honesty** and with the **highest standards**. We shall not commit scientific or academic misconduct, defined as plagiarism, fabrication, or falsification.

Community

Our community actively **includes all**, enhancing **collaboration** and promoting our common mission to advance the frontiers of knowledge.

Developed by Climate and Diversity Committee and Department

https://physics.yale.edu/statement-principles



Diversity, Equity, and Inclusion

Statement of Principles

Respect

We continually strive to make our department a place that respects people with diverse backgrounds and values each others' creativity.

Well-being

We commit to actively engage in creating a supportive and safe environment. Criticism and praise are professional and constructive.

Integrity

We carry out our work with honesty and with the highest standards. We shall not commit scientific or academic misconduct, defined as plagiarism, fabrication, or falsification.

Community

Our community actively includes all, enhancing collaboration and promoting our common mission to advance the frontiers of knowledge.

Developed by Climate and Diversity Committee and Department

https://physics.yale.edu/statement-principles







Research & Discovery









Education

Outreach







https://physics.yale.edu/diversity-equity-and-inclusion



Climate and Diversity Committee



chair: Dr. Rona Ramos

Mission

To support the Department's goals to provide a safe, supportive, and inclusive environment for every member of our community. We are committed to creating a work place whose core principles are based on diversity, equity, and inclusion for every staff member, student and faculty as we strive to obtain our goals of excellence in research, teaching, and mentoring.



Join the Yale Physics APS-IDEA Network



We are not alone!

National community to share success stories and ask for advice

Yale Physics, is now part of the <u>American</u> <u>Physical Society Inclusion</u>, <u>Diversity</u>, and <u>Equity Alliance (APS-IDEA)</u>, Its mission is to empower and support physics departments, laboratories, and other organizations to identify and enact strategies for improving equity, diversity, and inclusion (EDI). It will do so by establishing a community of transformation.

Team consists of Faculty, Postdocs, Graduate Students, Undergraduate Students and Staff

Early focus on establishing shared leadership

Building off of department's Climate and Diversity Committee (started in 2014)



DEI Activities for 2020-2021

- Writing the <u>DEIAP</u>, a community effort, vision statement and well defined action items and priorities
- More holistic graduate admission, with interviews and no GRE, graduate student participation on grad admissions committees
- Changes to qualifier and graduate curriculum. Committee including graduate students, discussion with Larry Gladney and committee
- Expanding recruiting to DNP, SACNAS, NSBP
- Title IX, bystander training included in new student orientation
- Creation of Graduate Diversity Fellowship
- Graduate Program Coordinator position created increased grad communication and support, advising on program updates with a focus on DEI related issues
- UGSAC undergrad advisory committee formed (GSAC formed 2019)
- Joint Astro-IDEA journal club forming
- Provided tutors for 1st year grad courses



Yale Physics Undergraduate Class of 2021



Amer Al-Hiyasat Nicholas Archambault India Bhalla-Ladd Joe Brownsberger Shoumik Chowdhury Caleb Clothier Rachel Cohen Vinicius Da Silva Krish Desai Noah Goodman Teddy Hague Gabe Hoshino Robert Howard Brett Jewell Shantanu Jha Derek Kuldinow Claire Laffan Alex Lathem

Yale Physics

Yale Physics Undergraduate Class of 2021



Vuong Mai Lucy McEwan Mike Ogego Kevin O'Neil Shaun Radgowski Sajan Ramanathan Benjamin Rosand Isabel Sands Sukhman Singh Tyler Tavrytzky Miles Waits Chris West Amber Young Benjamin Zolkiewicz

Yale Physics

Yale Physics PhDs

May 2021

Soner Albayrak (David Poland) Tyler Lutz (John Wettlaufer) Ryan Petersburg (Debra Fischer) Mariel Pettee (Sarah Demers) Daniel Seara (Michael Murrell) Olivier Trottier (Jonathon Howard) Christian Weber (Keith Baker) Sisi Zhou (Steve Girvin) Yuqi Zhu (David DeMille)

20 PHDs in 2020-2021

December 2020

Stephen Albright (Charles Ahn) Supraja Balasubramanian (Bonnie Fleming) Estella Barbosa de Souza (Reina Maruyama) Joshua Burt (John Murray) Shany Danieli (Pieter van Dokkum) Thomas Hays (Michel Devoret) Judith Hoeller (Nicholas Read) Scott Jensen (Yoram Alhassid) William Sweeney (Douglas Stone) Hao Yan (Simon Mochrie) Mengzhen Zhang (Douglas Stone)



Phd Recipients May 2021

2

May 2021

Teaching During the Pandemic

Physics 165/166

- Developed, assembled, mailed experiment equipment for all new athome lab activities developed for 2020 and 2021 virtual labs. (Cahn/Barrett)
- Currently installing new computers to replace 10+ year old computers
- Developed modified gyroscope to replace old models. In prototype



Physics 205/206

- Developed virtual lab curriculum around iOLab sensor device. Included an at home self-directed final project
- Introduced basic python data analysis and display (Matplotlib, Scipy, numpy) into regular 205 and 206 Labs
- upgrades to several labs



Advanced Lab Phys 382

- New Muon Lifetime Lab
- Quantum Entanglement experimental suite (coming soon)
- Ammonia Inversion
 Experiment



Inaugural Physics Department Challenge

- Monthly challenge for all students
- Prize for first correctly submitted solution

• September challenge won by:

Nicolò Tampellini Dept. of Chemistry





No Yale Physics Olympics in 2020-2021

Maybe in spring 2022



Yale Physics on Science Hill (and West Campus)



Yale Physics on Science Hill



Wright Laboratory (WL)

- experimental laboratories and facilities
- nuclear, particle, astrophysics

Teaching Laboratories (SCL)

Yale Science Building (YSB)

- biological physics

Sloan Physics Building (SPL)

Yale Physics

- lectures
- central office
- AMO, bio, condensed matter
- theory

Hill House (HH)

- particle physics
- astrophysics
- astronomy



KT completion in summer 2023

New Physics Lab in YSB lab - Jack Harris' Group



New Physics Lab in YSB lab - Jack Harris' Group



New Physics Labs in YSB - Prof. Mochrie

2-color single-particle tracking and optical tweezers microrheology



Yale Physics

Yale Physics on West Campus





Energy Sciences Institute (ESI) Eduardo da Silva Neto Steve Konezny

Systems Biology Institute

Ben Machta

Physics is growing on West Campus



©2018. For use while the West Campus landscape improvement project is under way. Note parking lot identifiers A–H and J and shuttle stops **S**.

New Physics Labs on WC - Prof. da Silva Neto



da Silva Neto Lab

Investigating Novel Quantum States of Matter

Department of Physics Energy Sciences Institute



•



• Helium recovery and liquefaction plant.

- Laboratory designed for experiments sensitive to lowvibrations.
- Acoustic enclosure rooms to house scanning probe instruments.

da Silva Neto Lab

Investigating Novel Quantum States of Matter

Yale Department of Physics Energy Sciences Institute

Adrian Gozar Research Scientist



Tim Boyle UC Davis PhD Year 6 Yale VAR



Morgan Walker UC Davis PhD Year 5 Located in CA





S ALFRED P. SLOAN FOUNDATION

Kirsty Scott Yale PhD Year 2





da Silva Neto Lab

Investigating Novel Quantum States of Matter

- Resonant inelastic x-ray scattering (RIXS) experiment reveals key signatures of electron-electron interactions in a cuprate high-temperature superconductor.
- Effective non-monotonic Coulomb interactions in the many body system leading to the spontaneous breaking of translational symmetry.

YaleNews EXPLORE TOPICS -

Rethinking the fundamental way electrons interact in superconducting quantum materials

By Jim Shelton JANUARY 26, 2021





ARTICLE

Check for update

https://doi.org/10.1038/s41467-020-20824-7 OPEN

Dynamic electron correlations with charge order wavelength along all directions in the copper oxide plane

F. Boschini[®] ^{1,2,3}, M. Minola[®] ⁴, R. Sutarto[®] ⁵, E. Schierle[®] ⁶, M. Bluschke^{4,6}, S. Das⁷, Y. Yang⁷,
M. Michiardi^{1,2,8}, Y. C. Shao⁹, X. Feng⁹, S. Ono¹⁰, R. D. Zhong¹¹, J. A. Schneeloch¹¹, G. D. Gu¹¹, E. Weschke⁶,
F. He[®] ⁵, Y. D. Chuang⁹, B. Keimer[®] ⁴, A. Damascelli[®] ^{1,2}, A. Frano[®] ⁷ & E. H. da Silva Neto[®] ^{1,2,13,14™}



Research Areas

broad research portfolio in experiment and theory

new science initiatives on campus

- quantum science
- data science
- instrumentation

https://physics.yale.edu/research



Yale Physics in Research Centers & Institutes



YCAA Yale Center for Astronomy and Astrophysics

Y() Yale Quantum Institute



Yale's Integrated Graduate Program In PHYSICAL and ENGINEERING BIOLOGY

Systems Biology Institute





ESI Energy Science Institute

Quantitative Biology Institute [QBio]

Yale Physics

Yale Center for Astronomy and Astrophysics (YCAA)

Established in 2001 by Prof. Meg Urry, founding Director

Keck, Palomar telescope access (2 proposal cycles per year)

Institutional member of Sloan Digital Sky Survey Chilean collaboration, access to Chilean telescope facilities

Annual YCAA Prize Postdoctoral Fellowship (application deadline Nov 5)

Joint colloquia, journal clubs, seminars

Joint Astro Activities of Physics and Astronomy Departments

YCAA Prize Postdoctoral Fellowship



Yale Center for Astronomy and Astrophysics (YCAA)

Third Granville Academy



Prof. Meg Urry Louise Edwards Malena Rice

week of diversity, equity and inclusion workshops for undergraduate students doing summer research in astronomy and physics



Wright Laboratory

Exploring the Invisible Universe





Advance understanding of the physical world, from the smallest particles to the evolution of the Universe, by engaging in fundamental research, developing novel applications, training future leaders in research and development, educating scholars, and enabling discovery. <u>https://wlab.yale.edu</u>

Wright Laboratory - Highlights





Wright Lab RHIG group integral in success of launch of Electron-Ion Collider Project at BNL

The search for dark matter with HAYSTAC gets a speed boost from quantum technology

Yale High Energy Neutrino Physics Group developing new neutrino detector technologies

Maruyama elected member of Connecticut Academy of Science and Engineering and named 2020 APS Fellow Professor O. Keith Baker and alumni Charles D. Brown II and Brooke Russell named as an inspiring Black scientists in America by the Community of Scholars

Yale Quantum Institute



The Vision

The Quantum Institute facilitates the research and teaching of quantum science on the Yale campus. YQI performs outreach in the form of seminars, workshops, and by hosting leading scientists from around the world.

- Capitalize on Yale's lead in the area of quantum information.
- Build a reputation for excellence at Yale in a 21st century growth area in basic and applied physical science.
- Ensure that Yale becomes the intellectual epicenter in the future of quantum information science and technology.
- Leverage the advantage in *this* area to help Yale excel in *other* related and emerging areas of science. (infrastructure!)
- Attract and train the next generation's leaders to carry out the quantum information revolution.

Meng Cheng Steve Girvin Jack Harris Sean Barrett David deMille Leonid Glazman Reina Maruyama Nir Navon David Moore Nicholas Read Ramamurti Shankar Karsten Heeger



New Quantum Center Grants





Co-Design Center for Quantum Advantage \$115M/5 years 25 Institutions, 88 Pl's



Yale Pl's: Schoelkopf, Devoret, Rakich, Ahn, Tang, Girvin, Glazman



New Quantum Center Grants



The NSF Quantum Leap Challenge Institute for Robust Quantum Simulation

\$25M/5 years

(Yale PI: S. Puri)



Quantum Science and Engineering @ Yale

New Faculty Hires

Shruti Puri (AP, Quantum Information Theory) Yongshan Ding (CPSC, Quantum Computer Architecture/Systems)

Current Faculty Searches

Senior Atomic/Molecular/Optics Experiment (Physics) Senior Quantum Experiment (AP)

New Quantum-related Courses at Yale

- APHY 691 Quantum Optics (Shruti Puri)
- APHY 660 Quantum Information & Computation (Shruti Puri)
- PHYS 345 Introduction to Quantum Information Processing and Communication (Steve Girvin)
- CPSC 647 Quantum Computer Systems (Yongshan Ding)
- CHEM 584 Machine Learning and Quantum Computing in Chemistry and Materials Science (Victor Batista)
- MATH 708 Quantum Geometry and Topology (Daniel Douglas)
- PHYS 676 Introduction to Light-Matter Interactions (Peter Rakich)
- APHY 607 Modern Topics in Optics and Quantum Electronics (Peter Rakich)

Outreach event:

YQI Quantum Week @ Yale: April 8-14, 2022 http://quantum.yale.edu/Quantum-Week.html





Report of the University Science Strategy Committee



Topics of interest to Physics

priority areas

data science

quantum science

cross-cutting initiatives

instrumentation

diversity

+ a new Physical Sciences and Engineering Building

Yale Physics

New Physical Sciences & Engineering Building





New Physical Sciences & Engineering Building



The Opportunity

Program for the Physical Science and Engineering Building (PSEB)

- Intellectual hub for the Quantum Science, Engineering and Materials initiative (USSC)
- an Advanced Instrumentation Development Center (AIDC)
- Goal of opening building in 2026 (now ~2027)
- Expanded and upgraded core facilities
- Space to accommodate approximately 45 faculty and research labs
- Anticipated departments include MEMS, EE, CEE, CS, Applied Physics, and Physics

Stay tuned! Yale Physics

from PSEB Town Hall 2/25/20

Yale Physics Activities

Department of Physics

Home	About	Research	Academics	People	Media	Events	Outr
Divers	ity						

https://physics.yale.edu/calendar

Physics Seminar	Upcom	ing	Month	Week	Day	Year	All Even
Calendar							
External Seminars of Upcoming Events							
Interest	SEPTEMBER 13, 2021						
Physics Club & Prize							
Lectures Flyer	4:00pm Physics Club: Karsten Heeger, Yale University, "The State of the Department"						
Physics Club	SEPTEMBER 14, 2021						
Prize Lectures							
	1:00pm	YPP	DO Works	hop: Prepar	ing for Fa	culty	
Physics Internal		Posi	tions with	Bonnie Fler	ning and	David	
Activity Calendar		Mod	ore				

Join us, get involved! Many events will be hybrid

Yale Physics



September 10, 2021

Events

Monday, September 13

- 4:00 pm **Physics Club:** *The State of the Department,* Karsten Heeger, Yale University, zoom, password: 008008
- 4:00 pm **Molecular Biophysics & Biochemistry Seminar:** *Ubiquitination lessons taught by the bacterial pathogen Legionella pneumophila*, Zhao-Qing Luo, Purdue University, zoom. Host: Shanna Dickinson.

Tuesday, September 14

1:00 pm **YPPDO Workshop:** *Preparing for Faculty Positions*, Bonnie Fleming and David Moore, Yale University, zoom, password: 083654

Wednesday, September 15

- 1:00 pm Yale Systems Biology Institute Seminar: Signal encoding and decoding in dynamical live cell systems, Andre Levchenko, Yale University, zoom, password 688858.
- 2:30 pm **Mechanical Engineering and Materials Science Seminar:** *Classical fluid dynamics confronts modern research questions*, Howard Stone, Princeton University, contact department for zoom information.
- 3:30 pm **Earth & Planetary Sciences Colloquium:** *Earth's wild years: how large collisions shaped the early Earth*, Simone Marchi, Southwest Research Institute, contact department for zoom information.

Thursday, September 16

2:30 pm Astronomy Colloquium: Heavy Element Nucleosynthesis in the Era of Multimessenger Astronomy, Erika Holmbeck, Carnegie Observatories, contact

Looking towards the Future

We are preparing for a new Strategic Plan in Physics

I would like to hear from you!



- What do we aspire to be?
- What is our vision for Yale Physics?
- Where do you see Yale Physics 5-10 year from now?
- How does Yale Physics fit into the scientific landscape at Yale in terms of teaching and research and broader university impact?



Goals for 2021-2022



Reconnect!

Have fun with science!

Build (for) the future of Yale Physics!

Have a great and productive year!

