Department Welcome and Town Hall

Academic Year 2023-2024

Karsten Heeger, Chair

Yale Physics Department

Yale Physics

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

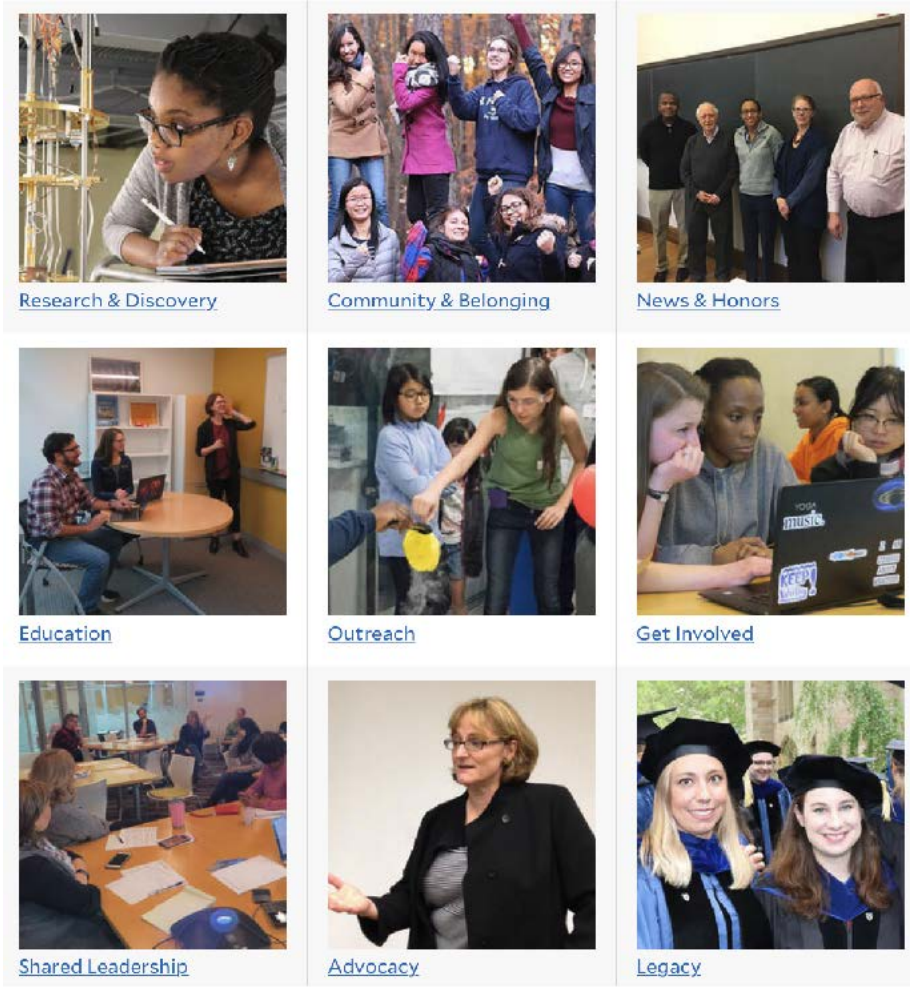
We carry out our work with **honesty** and with the **highest standards**. We shall not commit scientific or academic misconduct, defined as plagiarism, fabrication, or falsification.

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



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

Yale Physics

Chair’s Office

Chair’s Assistant

Jen Ongley

Chair’s Office

Kirstin Franzman

Yale Physics

Department Management

Director, Finance and Administration

Elena Siuzdak

Operations Manager

Maria White

Administrative Services Supervisor

Layla Nayar

Yale Physics

Undergraduate Program Team

Prof. Sarah Demers
Director of Undergraduate Studies

Daphne Klemme
Undergraduate Registrar

Undergraduate Student Advisory Committee (UGSAC)

Ethan Martinez, YC'26

Rachel Merrill, YC'24

Rose Powers, YC'24

Ben McDonough, YC'24

Sophie Getz, YC'24

Sofie Fusco, YC'24

Andrew Nupp, YC'25

Aaron Chizhik, YC'25

Yale *Physics*

Special Physics Club - October 9, 2023

Hoodie Ceremony

Introductory remarks by Prof. John Wettlaufer

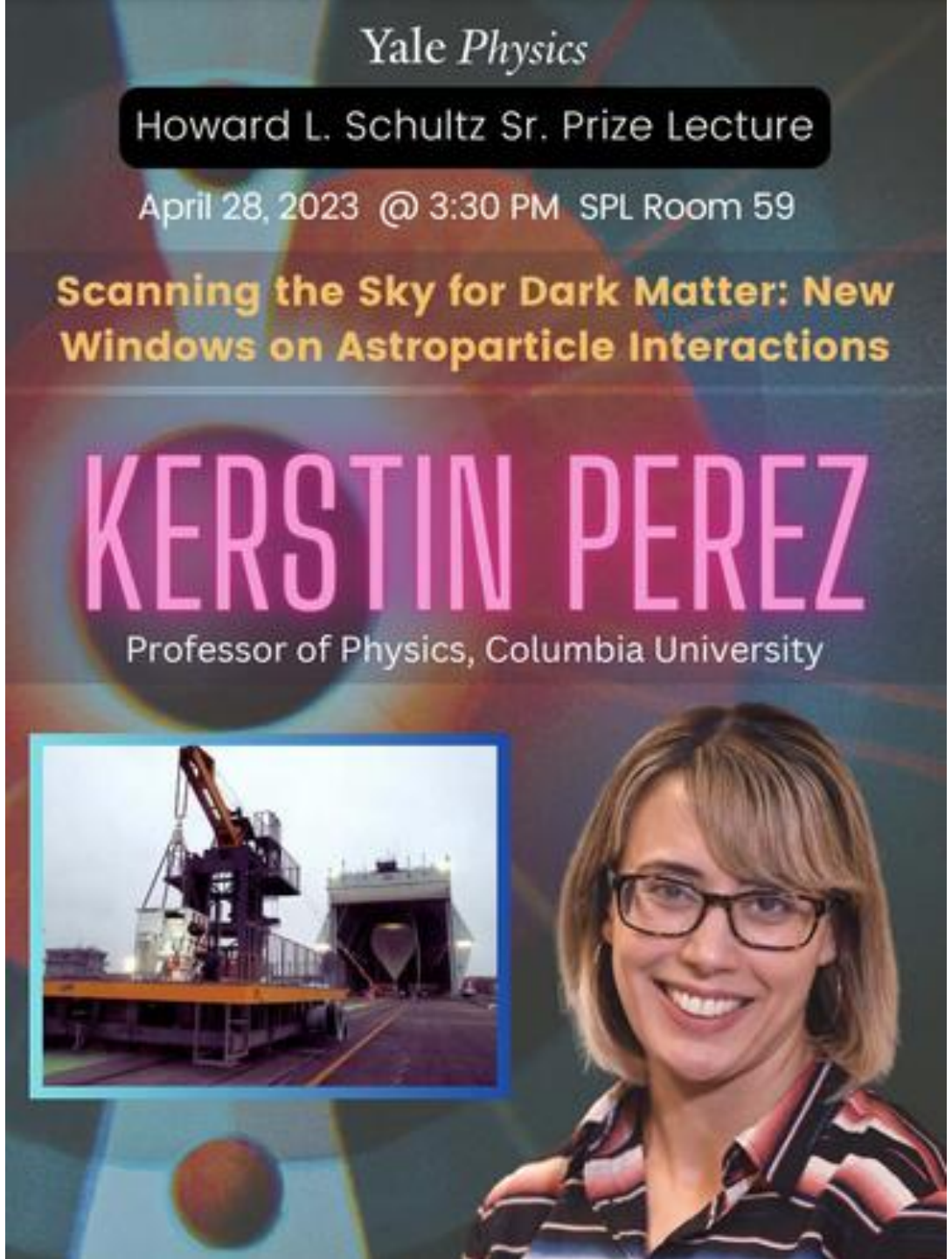
Short Physics Club on Nobel Prize

Please join us!

Yale Physics

Schultz Lecture

Planning the next Schultz Lecture



Yale Physics

Graduate Program Team

Prof. Daisuke Nagai
Director of Graduate Studies

Prof. Helen Caines
Director of Graduate Admissions

Dr. Rona Ramos
Graduate Program Coordinator
Lecturer

Stacey Watts
Graduate Registrar

Yale *Physics*

Yale Physics Graduate Program

People

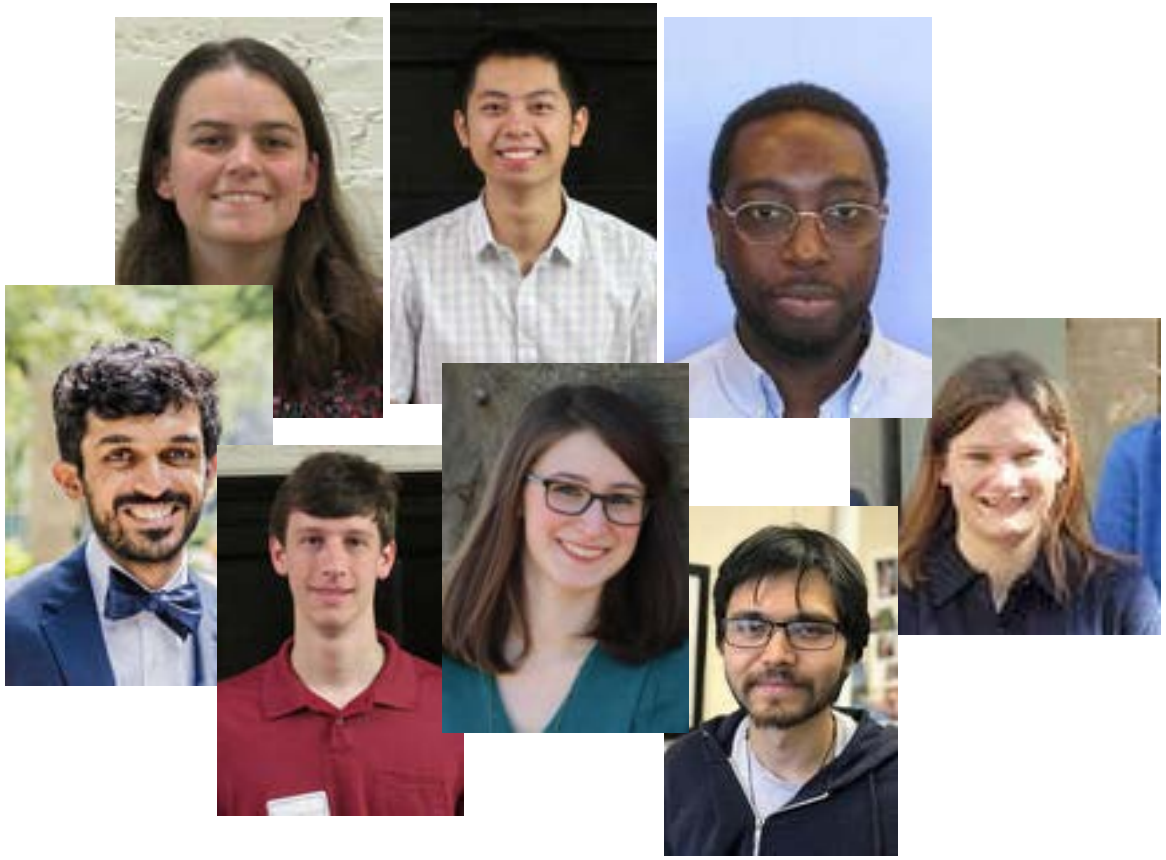
faculty (primary)	36
faculty (secondary)	32
grad students (physics only)	166

Median time to graduation 6.5 yrs

Diverse interests/ interdisciplinary opportunities

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

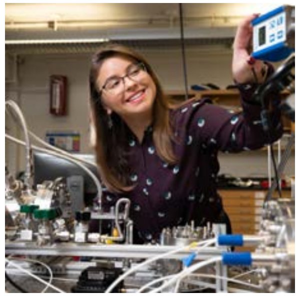
Recent Alumni



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

Yale Physics

Welcome First Year Students 2023-2024

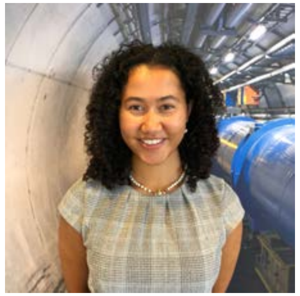








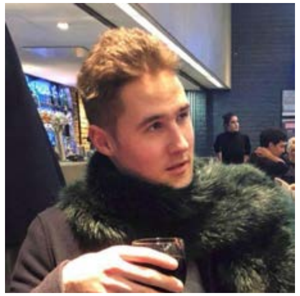














Yale *Physics*

Graduate Student Advisory Committee (GSAC)

What does GSAC do?

- ***Point of Communication*** *between Grad students and Administration*
- ***Advocacy*** *on behalf of grad student issues to the Chair, DGS, and grad student team.*
- ***Events*** *we organize annually scheduled department events, such as Open House.*

If you have experiences or opinions you'd like to share on:

- ***the Qualifying event***
- ***University Fellowships***
- ***Hiring processes and Admissions … and more***

We are looking forwards to gathering your input to improve these areas!

Please talk to your representatives!

We aim to have representation from each cohort to ensure a diversity of experiences are included.

Year 2 – Andrew Neely (andrew.neely@yale.edu)

Year 3 – Katie Chang, Braedyn Au (katie.chang@yale.edu, braedyn.au@yale.edu)

Year 4 – Charles Lomba (charles.lomba@yale.edu)

Year 5 – Andy Ding (zhenghao.ding@yale.edu)

Meetings, Minutes, and Information: https://physics.yale.edu/academic/graduate-studies/GSAC

Postdoctoral Affairs

Prof. Meg Urry
Director of Postdoctoral Affairs

Postdoctoral Advisory Committee (PDAC)

Isabella Graf, Postdoctoral Associate with Ben Machta

Yogesh Patil, Associate Research Scientist with Jack Harris

Instructional Labs, Demonstrations & Outreach

Stephen Irons
Director of Instructional Labs

Caitlin Hanssen
Lecturer

Paul Noel
Instructional Support Specialist

- New labs
- New apparatus
- New demonstrations
- Material updates
- The return of outreach
- Crafts and puzzles

New Faculty

Charles D. Brown

Laura Havener

Chris Lynn
arriving January 2024

Konrad Lehnert
arriving summer 2024

Chiara Mingarelli

Yale Physics

Meet the Team

PI: Charles Brown

Cedric Wilson

Andrew Neely

Ryan Everly

Research Goals

General: single, few and many-body quantum physics

Specific:

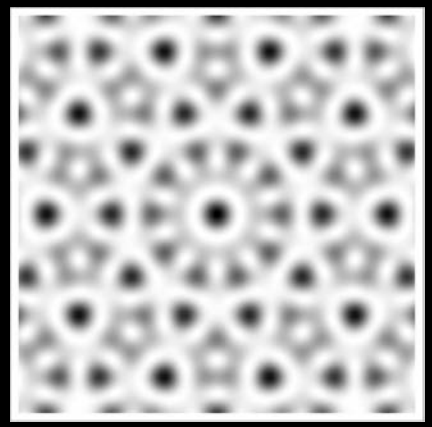
- Wavepacket dynamics: fractality and topology
- Quantum phases of quasicrystals
- Connections to physics of higher spatial dimensions?
- 2D phason dynamics

BROWN

Experiment Under Construction

Features:

- Bosonic and Fermionic Quantum Gasses
- Quantum gases in optical lattices
- 5-fold quasicrystalline optical lattices



Location

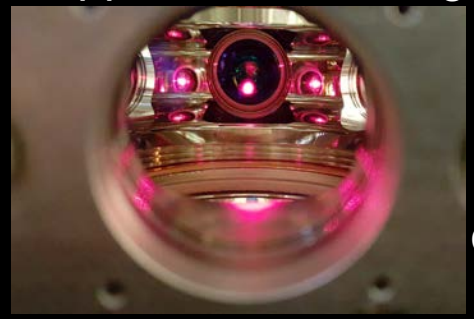
SPL

brownlab.yale.edu

brownlab_yalephysics

Goals for the Year

- Construct laser optical table
- Develop experiment control system
- Construct ultrahigh vacuum chamber
  - $P \sim 1 \times 10^{-11}$ torr (1 atm = 760 torr)
- Produce 3D MOT of Lithium @ $\approx 100\ \mu$K
- Sub-Doppler laser cooling to $\approx 10\ \mu$K

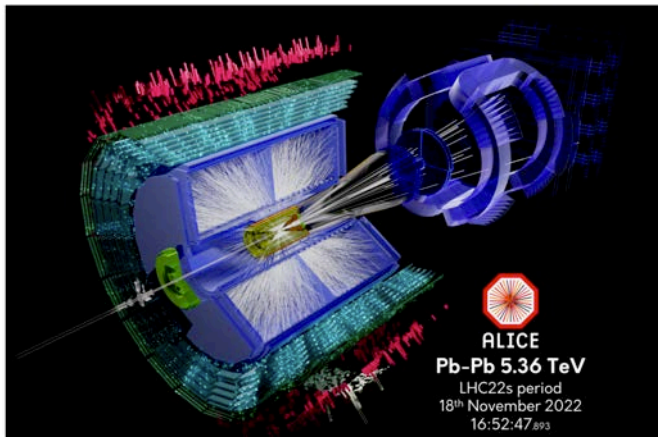


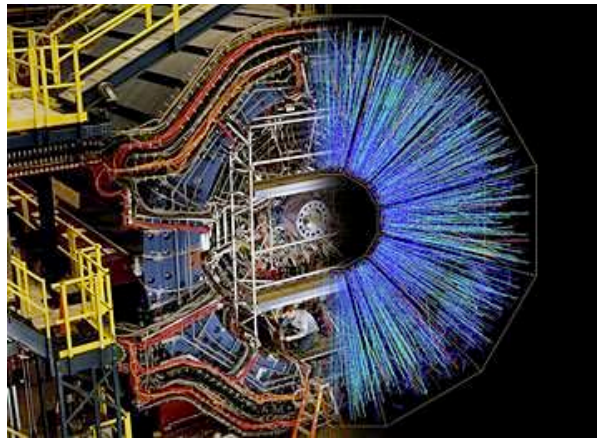
Credit: Wright Group (Dartmouth)

Laura Havener

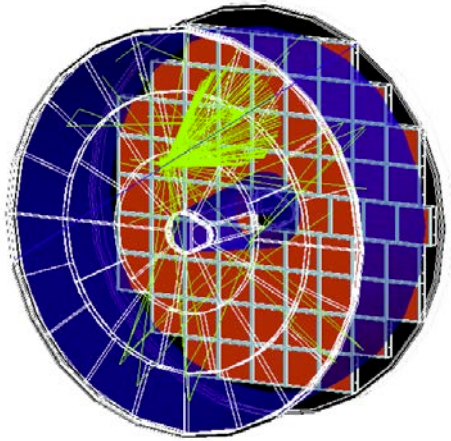
High-energy nuclear physics program in Wright Laboratory experimentally studying quantum chromodynamics (QCD) using high-energy particle colliders.

- ALICE experiment at the LHC and STAR experiment at BNL
  - Analyzing data from heavy-ion collisions to understand the properties and dynamics of the deconfined state of QCD matter called the quark-gluon plasma (QGP)





- Future Electron-Ion Collider at BNL
  - Detector R&D and Construction: characterizing the HRPPD (photosensor) for the ePIC Proximity-Focusing Ring-Imaging Cherenkov (pfRICH) Detector's sensor plane



Members of the Relativistic Heavy-Ion Group at Quark Matter 2023 in September!

Come visit in Wright Lab West!

Statistical physics of neural systems

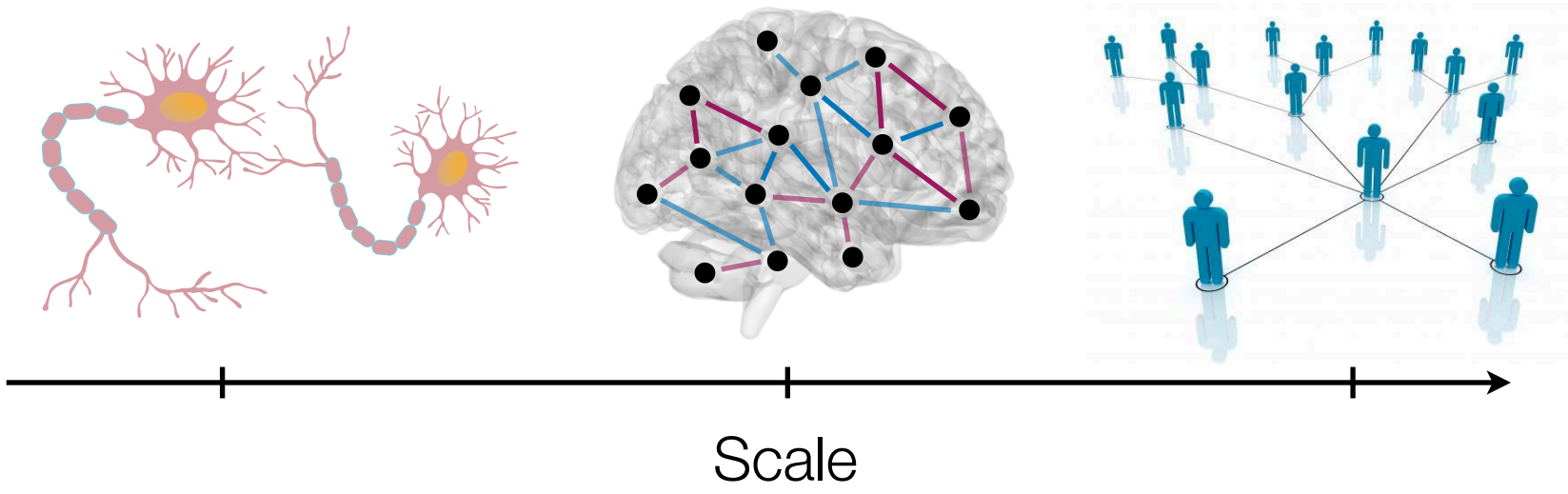
- Central question:

  How does neural function and structure emerge?

- Tools:
  - Statistical mechanics
  - Information theory
  - Network science

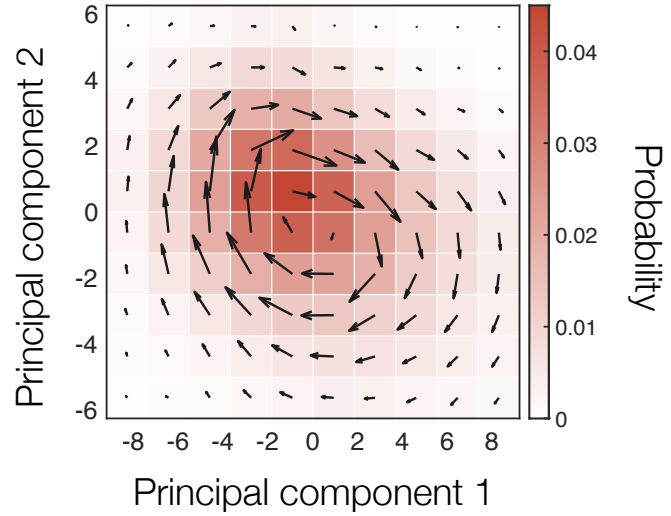
Christopher Lynn

- Across scales:

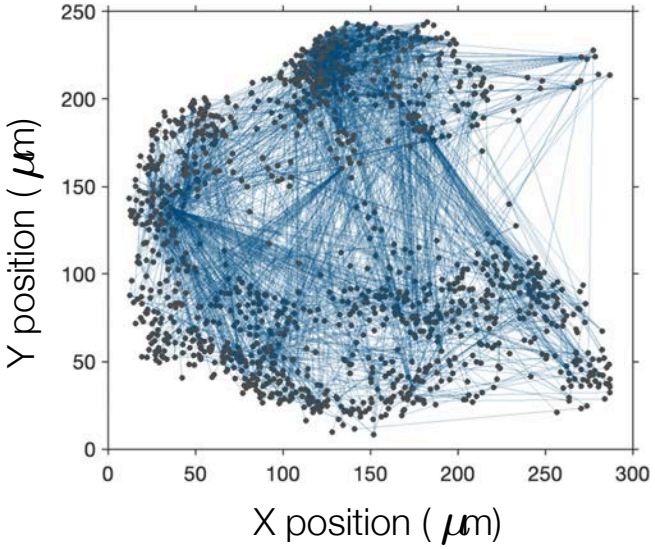


Directions

- Irreversibility and non-equilibrium neural dynamics
  - "Decomposing the local arrow of time in interacting systems" *PRL* (2022)
  - "Broken detailed balance and entropy production in the human brain" *PNAS* (2021)



- Emergence of network structure
  - "Heavy-tailed neuronal connectivity arises from Hebbian self-organization" *Nature Physics* (accepted)



- Large-scale models of neural activity
  - "Exactly solvable statistical physics models for large neuronal populations" *In prep.*

Lehnert group

DOE-HEP program

U.S. DEPARTMENT OF ENERGY
Office of Science

Fermilab

Q-SEnSE
An NSF Quantum Leap Challenge Institute

JILA pfc
an NSF physics frontier center

NSF

HEISING-SIMONS FOUNDATION

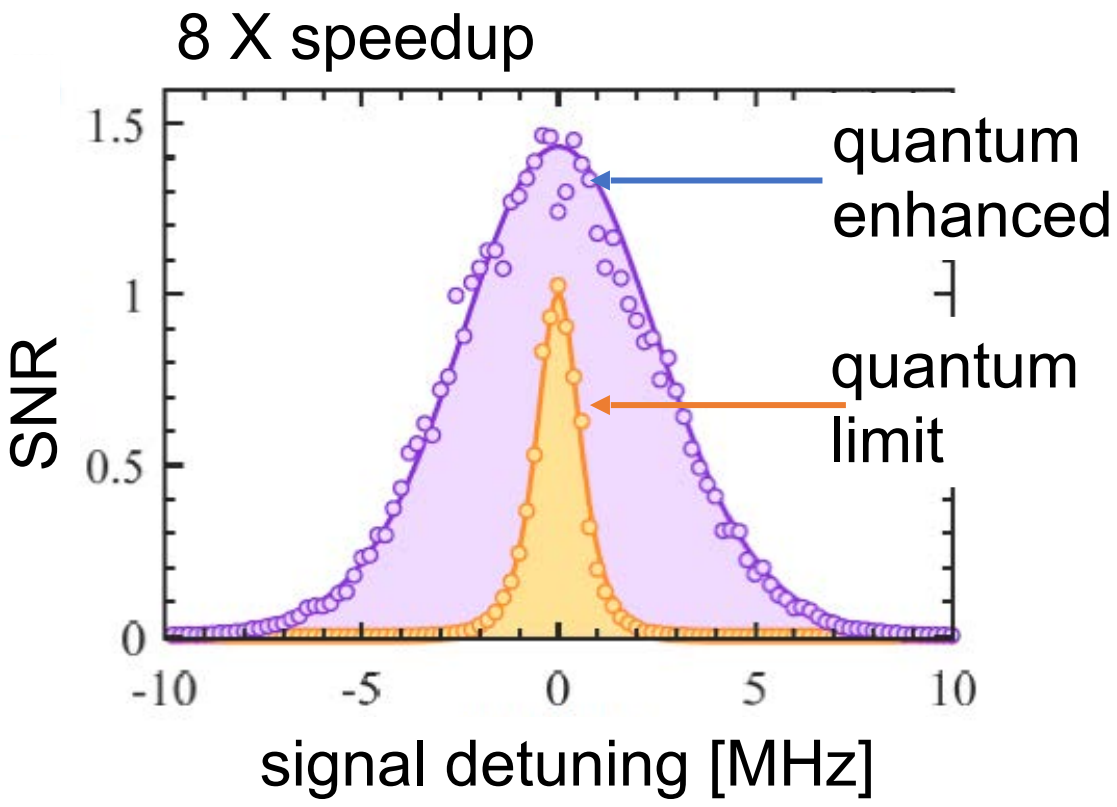
GORDON AND BETTY MOORE FOUNDATION

AFOSR
AIR FORCE OFFICE OF SCIENTIFIC RESEARCH

Office of Naval Research
ONR
Science & Technology

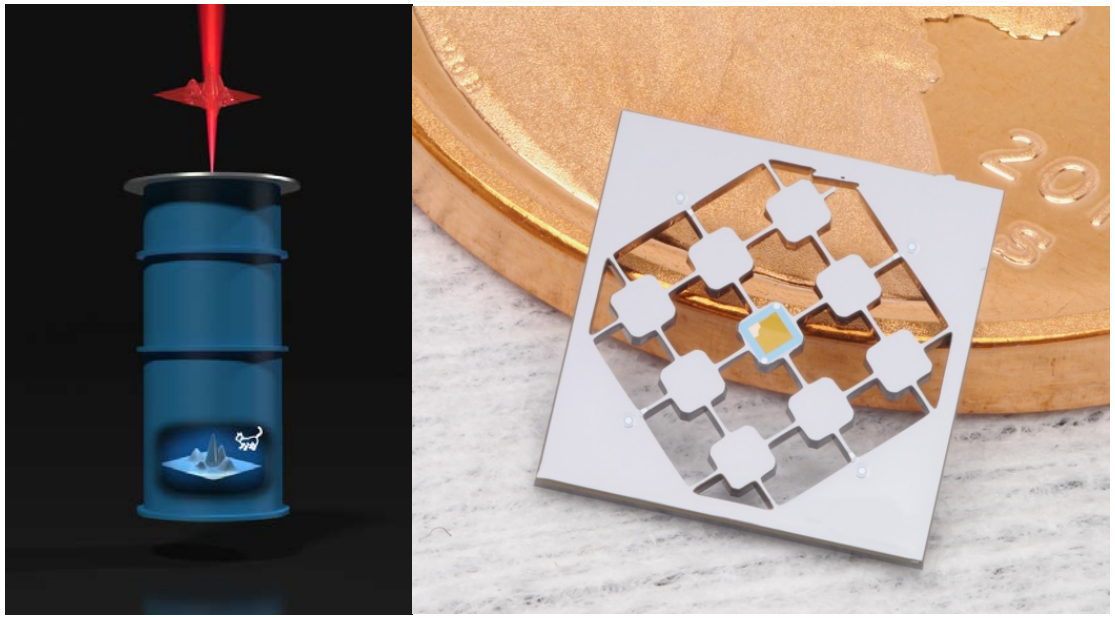
Lehnert group research

quantum enhanced sensing for dark matter searches



plans: deploy in HAYSTAC, develop for ALPHA

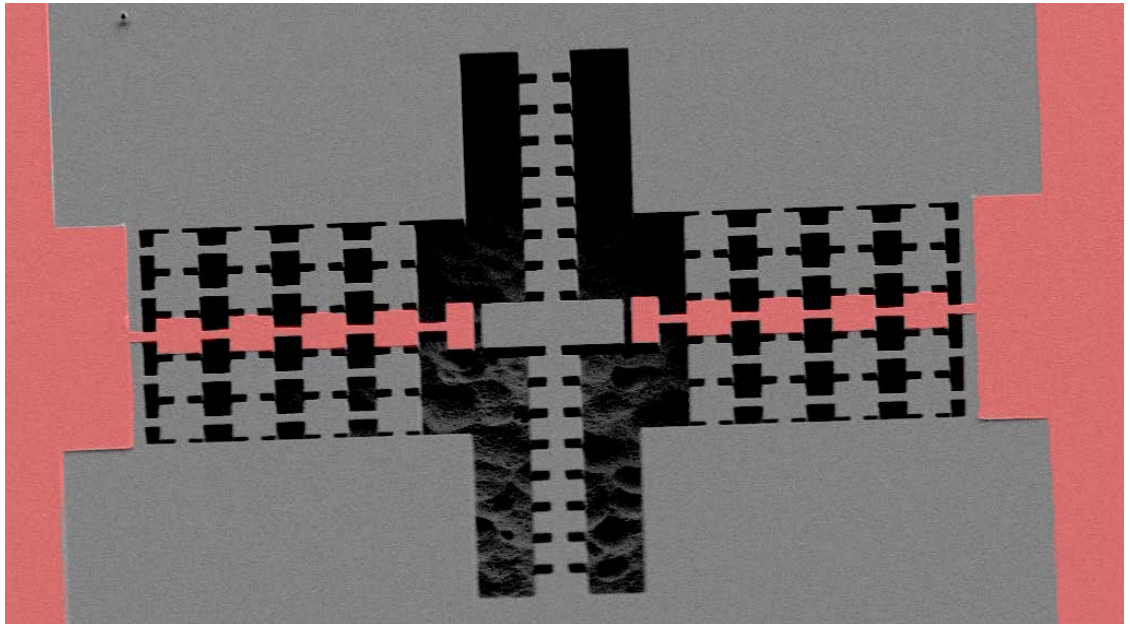
quantum transduction between electrical and optical domains



plans: entangle remote qubits optically

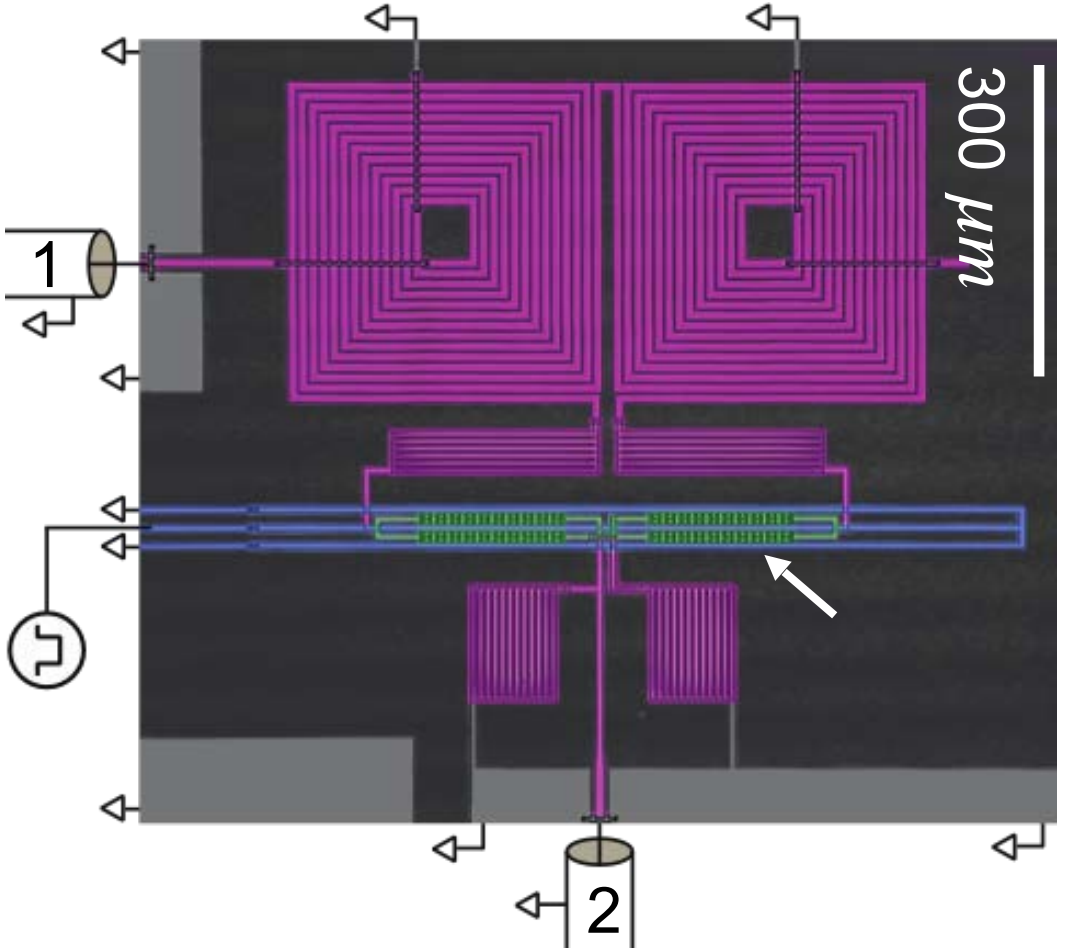
Lehnert group research

quantum acoustics and phononics



plans: integrate with superconducting qubits, entangle vibrational modes

analog quantum circuits



plans: develop quantum signal processing devices for computing and sensing

Interstellar medium

Advanced noise models for gas, dust, chromatic events

Improve pulsar distance measurements

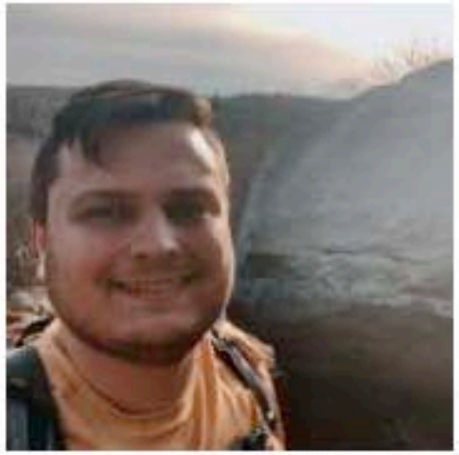
Mingarelli Lab

Where are these gravitational waves coming from?

Map the gravitational wave background,
And find the galaxies hosting SMBHBs

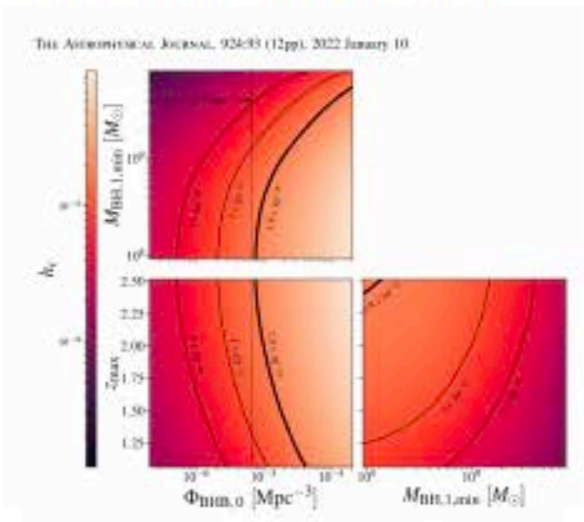
Chiara Mingarelli

Mingarelli Lab



Andrew Casey-Clyde (VAR)

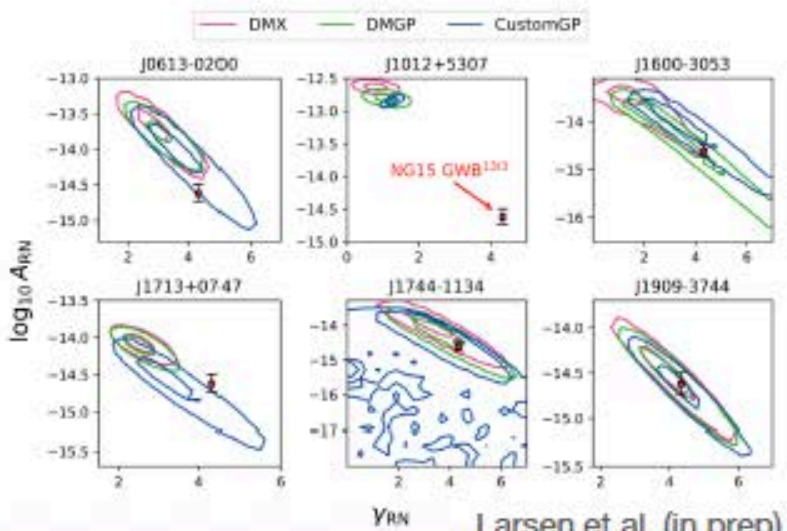
Multimessenger astrophysics: New and novel use of quasars to build models of the gravitational wave background



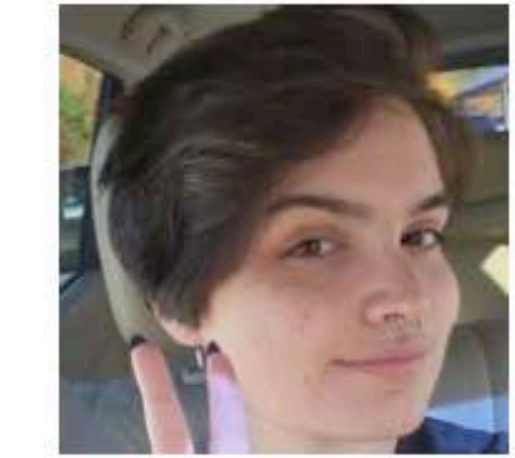
Casey-Clyde et al. 2022

Bjorn Larsen (Yale)

Custom noise models for NANOGrav and International Pulsar Timing Array pulsars to gravitational wave detections

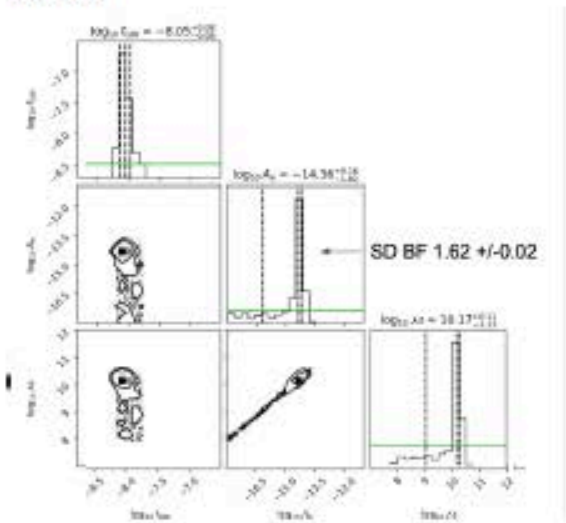


Larsen et al. (in prep)



London Willson (UConn)

Targeted searches for supermassive black hole binaries in active galactic nuclei



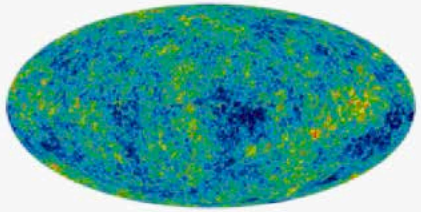
Willson et al. (in prep)

Research Areas

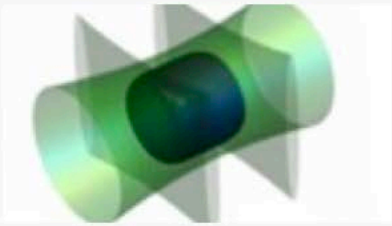
broad research portfolio in experiment and theory

new science initiatives on campus

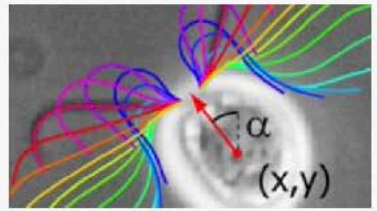
- quantum science
- data science
- instrumentation



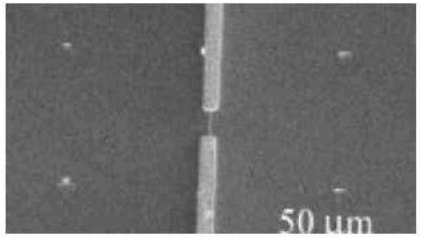
Astrophysics and Cosmology



Atomic, Molecular, and Optical Physics

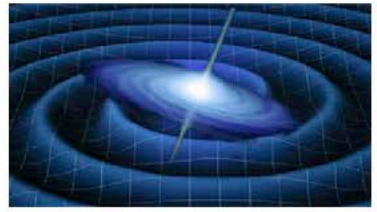


Biophysics

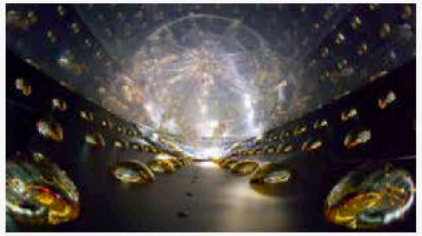


Condensed Matter Physics Experimental

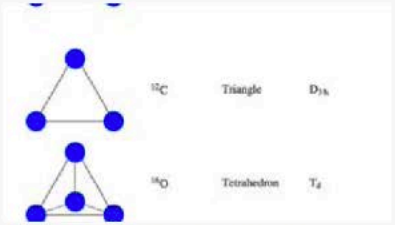
Condensed Matter Physics Theory



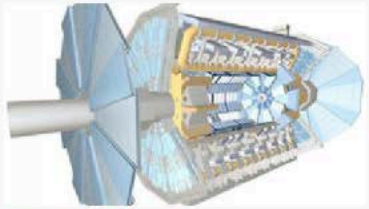
Gravitational Physics



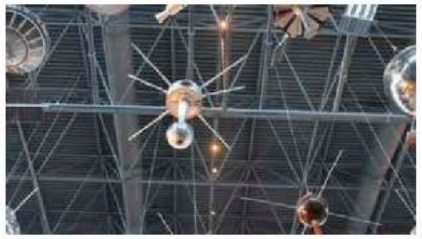
Nuclear Physics Experimental



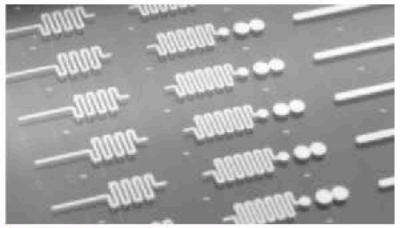
Nuclear Physics Theory



Particle Physics Experimental



Particle Physics Theory



Quantum Physics

https://physics.yale.edu/research

CS

Yale Physics in Research Centers & Institutes

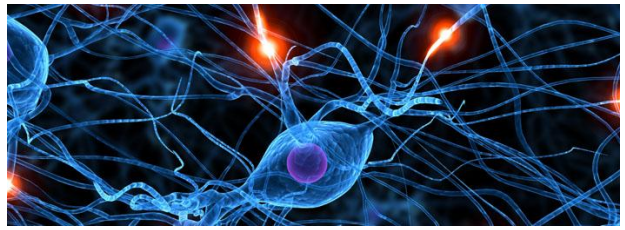
Wright Laboratory

YCAA Yale Center for Astronomy and Astrophysics

YQI Yale Quantum Institute

PEB *Yale's* Integrated Graduate Program In PHYSICAL and ENGINEERING BIOLOGY

Systems Biology Institute



ESI Energy Science Institute

Quantitative Biology Institute [QBio]

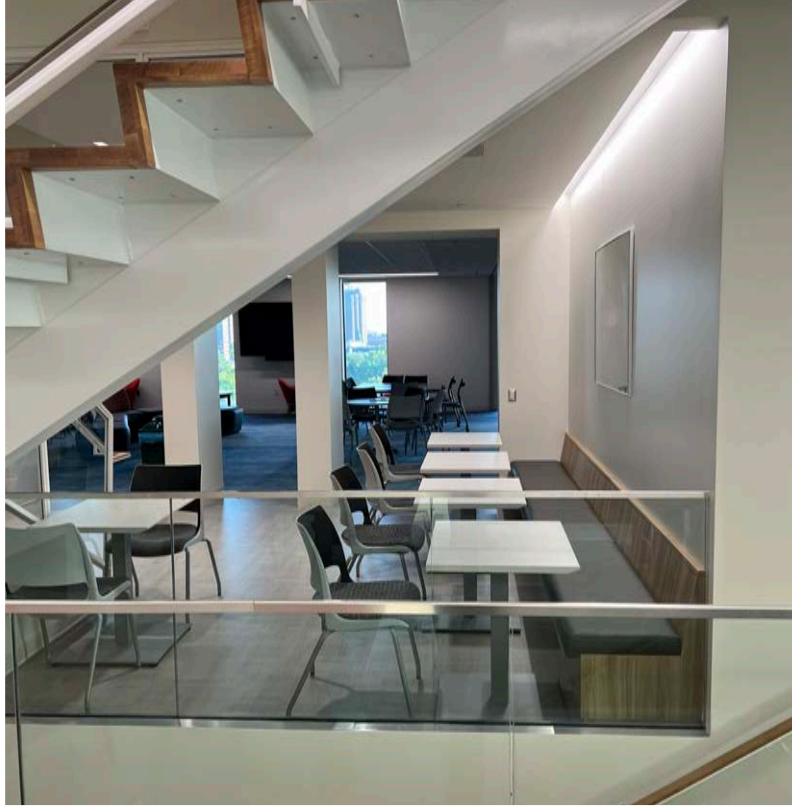
Yale *Physics*

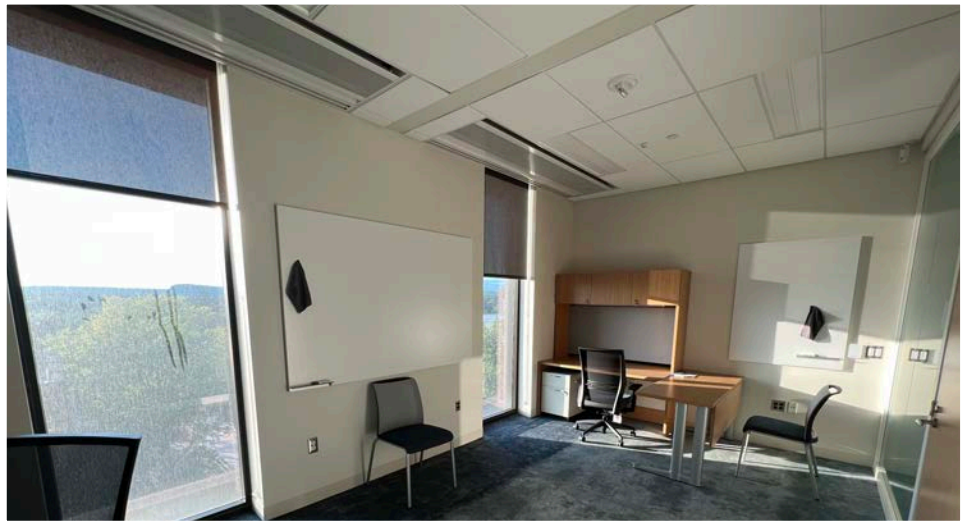

Construction in 2020-2023
May 2021
HITACHI

KT Opening

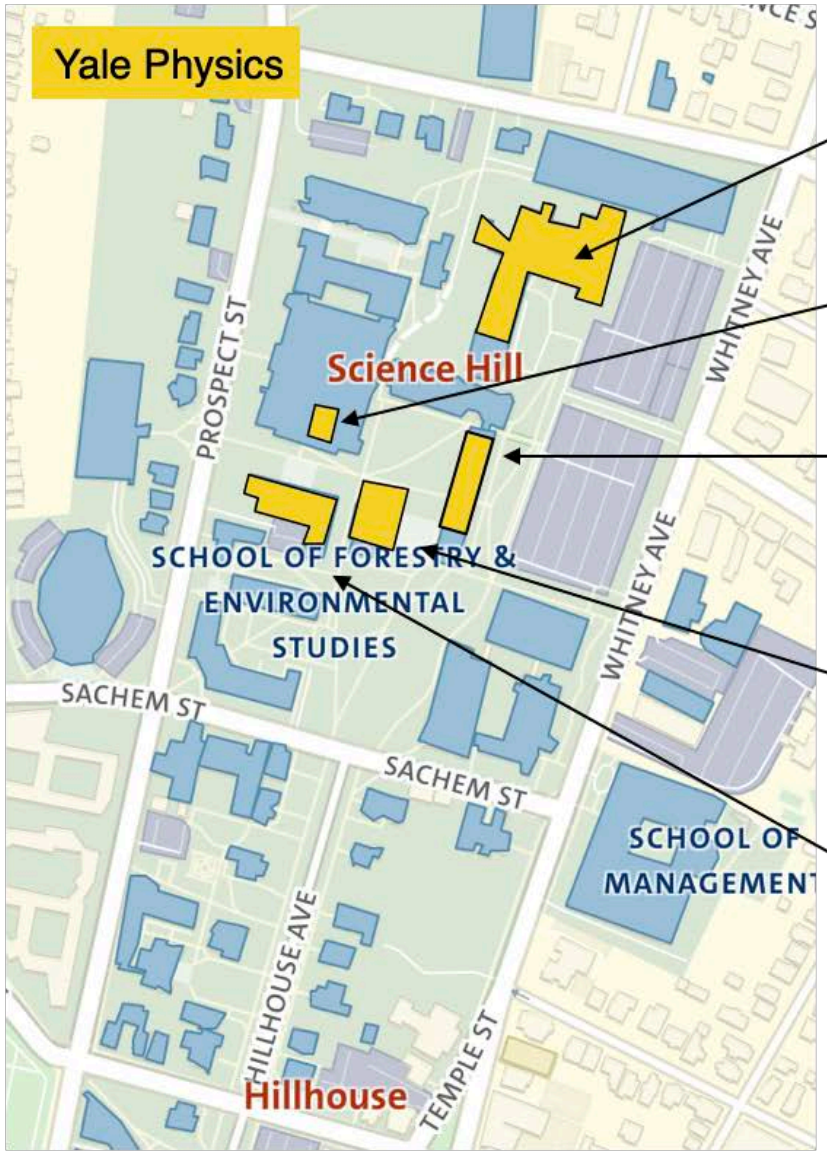
With astrophysics and some particle physics

Kline Tower





Yale Physics Department (on central campus)



Wright Laboratory (WL)
- experimental laboratories and technical facilities
- nuclear, particle, astrophysics

Teaching Laboratories (SCL)

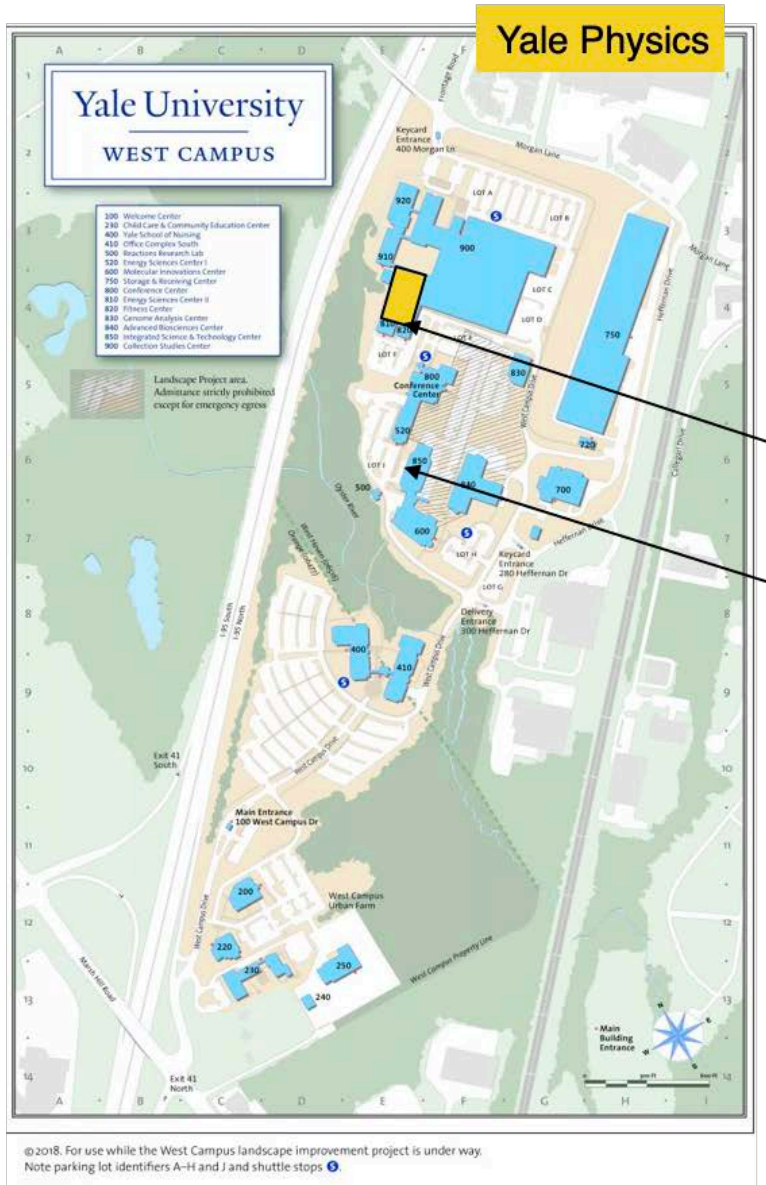
Yale Science Building (YSB)
- biological physics and QBio
- AMO, quantum science

Kline Tower (KT)
- astrophysics (and astronomy)
- particle physics, data intensive science

Sloane Physics Building (SPL)
- lecture halls, teaching
- central business office
- AMO, bio, condensed matter
- theory

Yale Physics

Yale Physics Department (on west campus)



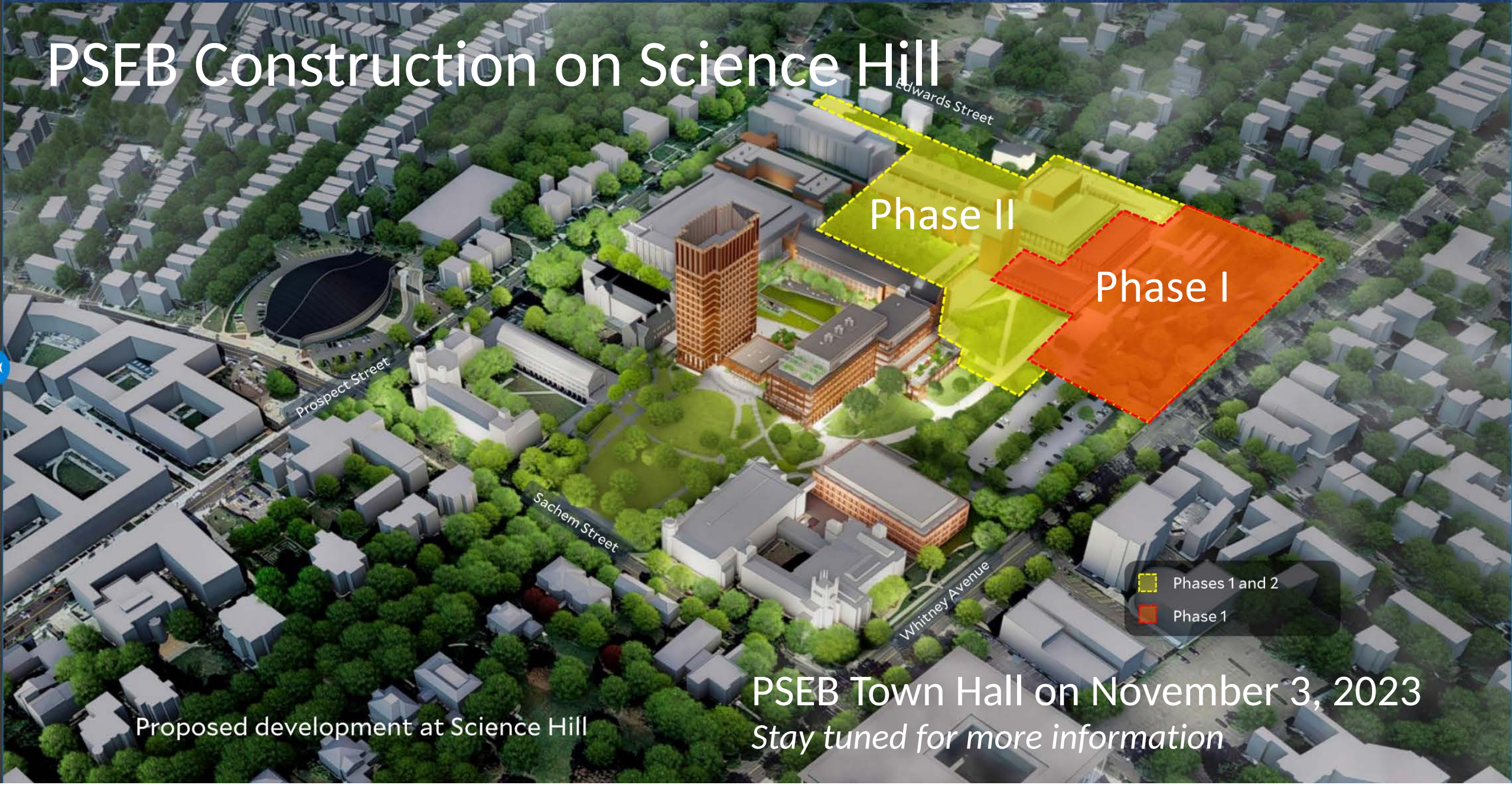
Energy Sciences Institute (ESI)
- Condensed matter physics, materials science

Systems Biology Institute

Yale Physics

Physicsal Science and Engineering Building (PSEB) on Science Hill

PSEB Construction on Science Hill



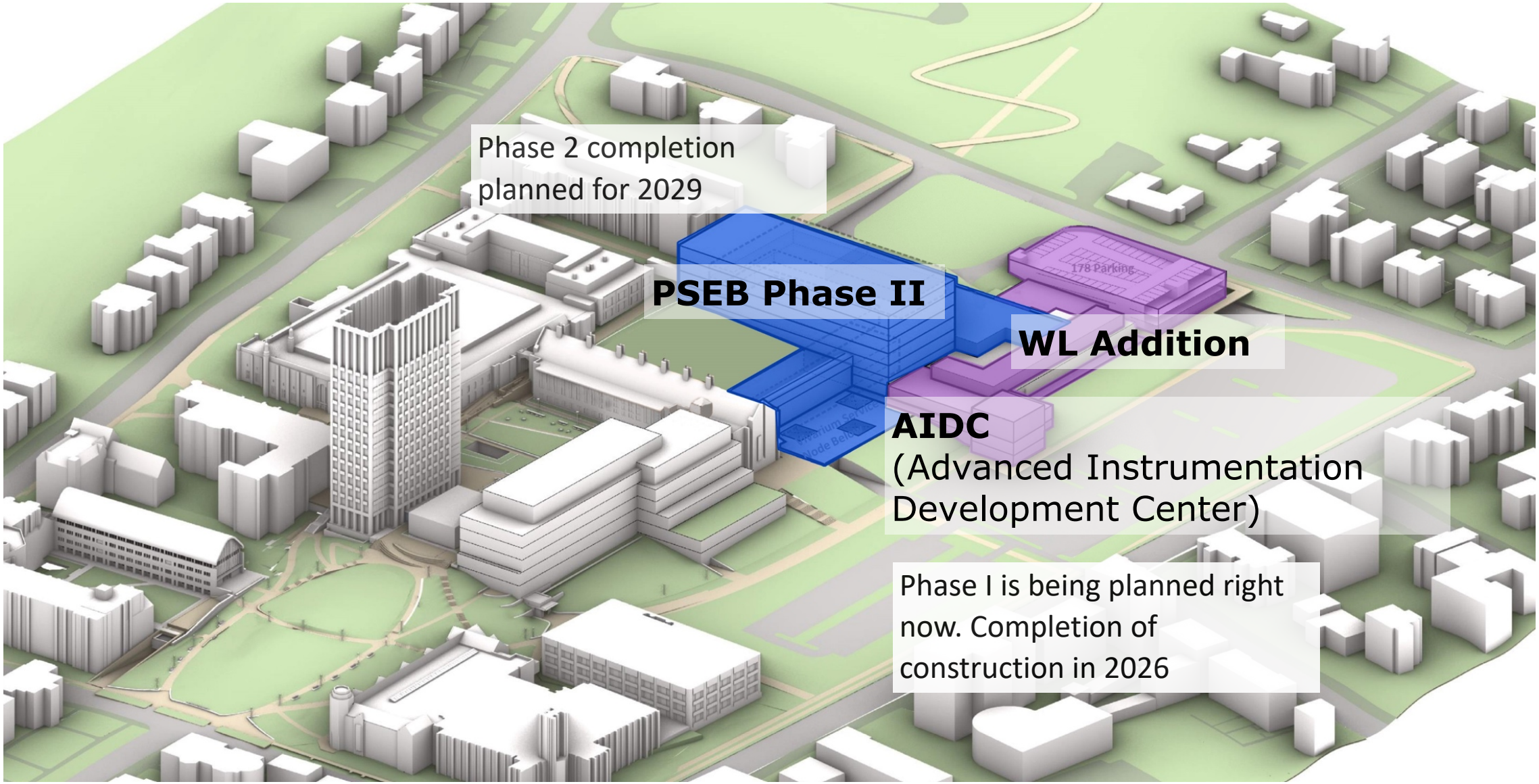
Proposed development at Science Hill

PSEB Town Hall on November 3, 2023

Stay tuned for more information

New Physical Sciences & Engineering Building

Wright Laboratory



Looking towards the Future

We are preparing for a new Strategic Plan in Physics

- 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?
- What are our aspirational goals?

Yale Physics

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.

Balancing shared leadership and task force

> Will set up committee of representatives

Yale Physics

APS Inclusion, Diversity, and Equity Alliance (APS IDEA)

Shared effort across universities and national labs

2-3 workshops per year focusing on the mechanics of institutional change and social justice in physics communities

Network support of change efforts through smaller learnin communities and network leadership

Contact: Rona Ramos (rona.ramos@yale.edu)

https://www.aps.org/programs/innovation/fund/idea.cfm

Department of Physics
Outreach Committee

The committee plans, coordinates and promotes the different outreach activities in the Physics Department including but not limited to Girls Science Investigations, Pathways to Science, Physics Olympics, and the Physics Open House. The committee also works with the Physics Chair on preparing proposals and budget plans for the outreach activities and collaborates with Wright Lab and YCAA on their outreach programs.

- Stephen Irons (chair)
- Charles Brown
- Eduardo da Silva Neto
- Laura Havener
- Paul Noel
- Caitlin Hansen
- Victoria Misenti
- Rona Ramos
- UG & post doc reps (TBA)

- Meet once or twice a semester
- Plan and review future & past events
- Help others with outreach needs
- Provide leadership on established events
- Plan and manage budget
- Provide a liaison with the UG outreach efforts

Phantasmagorical Physics Demo Show

Lights, Frights, and Insights

Friday, October 27th , 6:30-8:30
Lecture + Demo Show
Interactive Intermission

- Speaker
- Demo: Host
- Presenters
- Writers
- Stage Manager/Crew
- AV/Tech
- Publicity

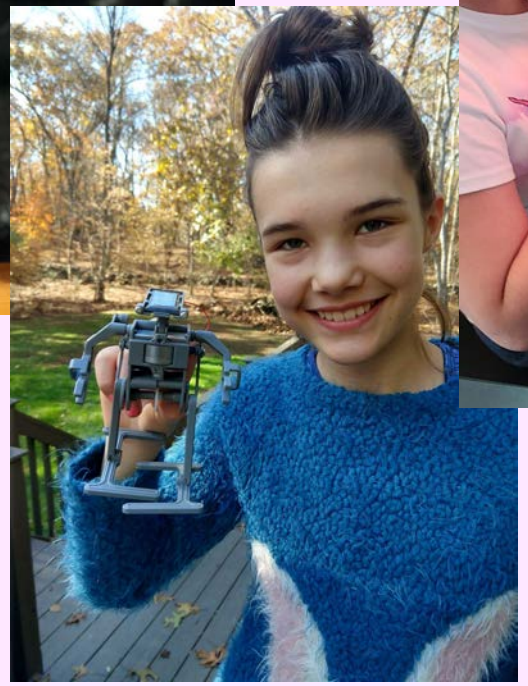
Yale Physics Olympics

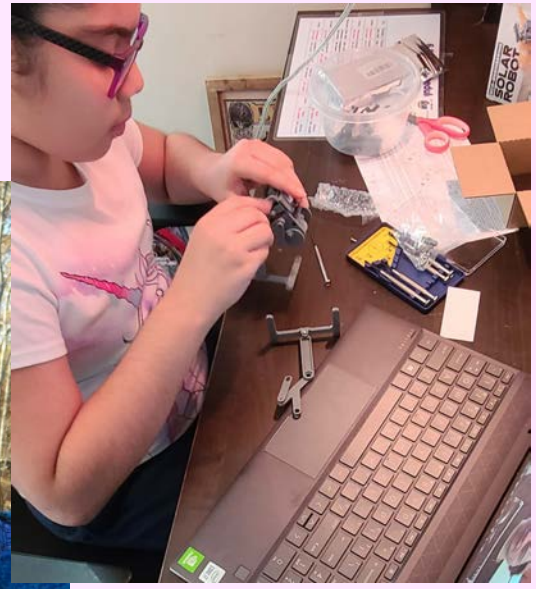
- Scheduled for Early April: (Saturday 8:00am – 5:00)
- Competitive event for high school students
- Teams of 4 compete in pentathlon of physics themed events
- Graduate students can help design and run the events
- Prizes for best event score and best overall performance
- 2X FFO (Lunch and dinner provided)

http://ypo.yale.edu

Girls' Science Investigations

Empowering and inspiring girls to pursue careers in science and engineering



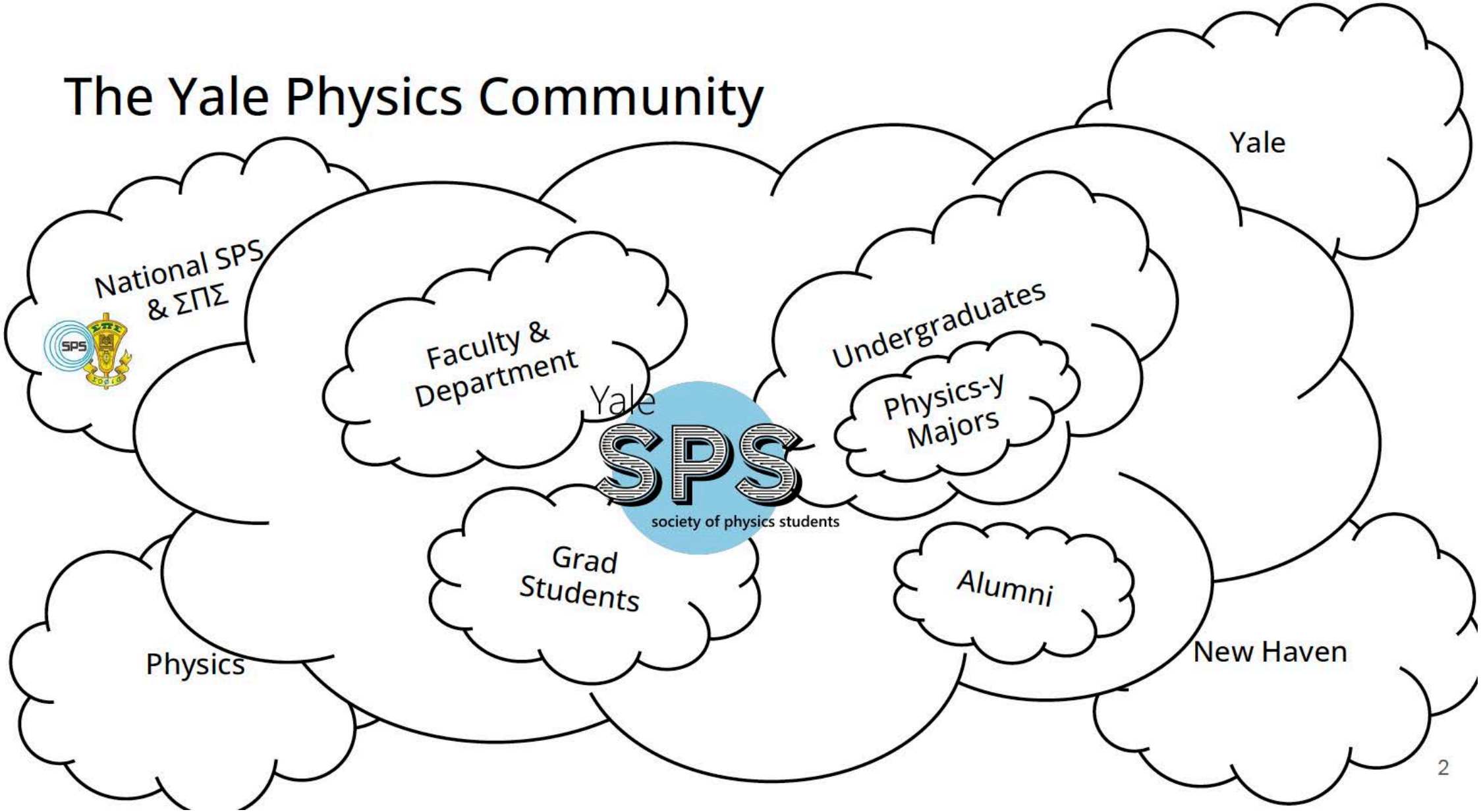


GSI invites middle school girls to explore science through fun projects. The projects are themed around concepts in physics, chemistry, and engineering.

The program relies on volunteers, primarily from Yale and local high schools. Anyone can volunteer if they want to make a better environment for women and girls in STEM!

Visit https://gsi.yale.edu

The Yale Physics Community



Yale Physics

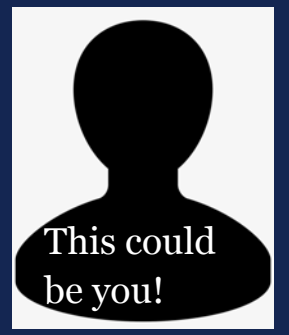
Student Groups, Activities, and Committees

- **GSA** - Graduate Student Assembly
- **GSAC** - Graduate Student Advisory Committee
- **Local 33** - Graduate Worker Labor Union
- **APS-IDEA** - American Physical Society Inclusion, Diversity, and Equity Alliance
- **YPO** - Yale Physics Olympics
- **GSI** - Girls Science Investigation
- **QuArk** - LGBTQ+ in physics
- **WIP+** - Women in Physics+
- **HoFoP** - History and Foundations of Physics Reading Group
- **Kimball Smith Series**
- **Graduate Theory Seminar**
- **Department Happy Hour**

gsa.yale.edu

Nominate yourself or your friends! Open spot for Physics rep:

Our guide to Yale and living in NH for new Grad students!



Representation

We are elected Physics graduate students that represent your interests in the GSA, the GSAS student government, and give you a direct line of communication to university leadership.

Advocacy

Our advocacy includes but is not limited to health care, housing, transportation, academic and career resources, and questions of diversity, equity, and inclusion. We meet with GSAS Deans, the Provost's Office, the University President, Board of Trustees members and other Yale admin to advocate for policy changes to help grad students.

Support

We provide services for all graduate students such as the *Conference Travel Fund, the GSA Food Pantry,* and *The Compass: A Guidebook to Life as a Graduate Student at Yale* (*gsa.yale.edu/compass*).

Get Involved!

GSA General Assembly Meetings are open to the public (1st meeting is Sept 6, 6pm, Watson A74/Courtyard) and Nominations for election are due by the EOD today!

Physics Graduate Student Advisory Committee (GSAC)

Representation

The composition of the committee includes at least one representative from each cohort, with a primary goal of representing inclusive and diverse sets of interests.

Year 1 - ?

Year 2 – Andrew Neely

Year 3 – Katie Chang, Braedyn Au

Year 4 – Charles Lomba

Year 5 – Andy Ding

NOMINATIONS EVERY JANUARY

Meetings, Minutes, and Information: https://physics.yale.edu/academic/graduate-studies/GSAC

Physics-GSAC@mailman.yale.edu

Point of Communication

Serves as a point of communication between graduate students and the administration of the department.

Advocacy

GSAC meets with the Chair and DGS at least once a month to advise them and advocate on behalf of graduate students within the department.

Events

GSAC members help organize annually scheduled department events, such as Open House.

Leadership

If you have any questions or concerns about the department, do not hesitate to reach out to one of us (via Slack, email, etc.)!

Local 33 - Graduate Worker Labor Union @ Yale

Update meeting on Wed. **October 4th**, meet at SPL 3rd floor lounge at **5:00 PM**

Contact us for more information!

andrew.neely@yale.edu (Year 2)
matthew.s.mitchell@yale.edu (Year 4)
ridge.liu@yale.edu (Year 6)

QuArk (QUeer-Affiliated fRiends of physiKs)

QuArk is Yale's LGBT-in-physics club!

Our events include:

- Lunches
- Game and movie nights
- Hikes
- Sunday morning bagel brunches

Want to get on the mailing list? Email me at matthew.s.mitchell@yale.edu.

Women in Physics+ Yale

Who are we? WIP+ is focused on **fostering a supportive environment for underrepresented genders** in the Physics, Applied Physics, and Astronomy departments. We **coordinate mentoring and social events** for graduate students, post-docs, research scientists, and faculty. The group and many events are open to all allies in the department, from whom we welcome support for our initiatives.

@yale_wip

yalewip

Questions? Ask Emily Pottebaum:
emily.pottebaum@yale.edu

- **Advocacy**
- **Lunch with allies**
- **Monthly bagel chats**
- **Special events: ice cream, apple picking, ice skating, potlucks, and more!**

History and Foundations of Physics Reading Group (HoFoP)

- Explore and discuss topics in the philosophy and history of physics, and of science more broadly.
- 3 meetings each semester, readings distributed in advance. Occasional guest speakers.
- Dinner and refreshments served
- This is an interdisciplinary group of students and faculty from science and humanities departments here at Yale

tinyurl.com/yalehofop
Yarone Tokayer (yarone.tokayer@yale.edu)
Molly Watts (molly.watts@yale.edu)

Yale
Department of Physics
Franke Program in Science and the Humanities

The Kimball Smith Series

Website: kimballsmithseries.yale.edu

Instagram: @kimballsmithseries

- The Kimball Smith Series tackles issues at the intersection of **technology, ethics, and global affairs.**
- Last year's events focused on **nuclear weapons, artificial intelligence, and quantum computing.**
- Each event features:
  - A **speaker panel**, with experts in scientific *and* political aspects of the topic;
  - Multidisciplinary, **small-group discussions among attendees**.

Sponsor: *Physics Department*

Partners: – *Political Science Department*
– *International Security Studies at Jackson*
– *Bulletin of the Atomic Scientists*

The Kimball Smith Series

Website: kimballsmithseries.yale.edu

Instagram: @kimballsmithseries

Topics for upcoming programs include:

- **Climate change** and international negotiations
- **Outer space** and global security
- **Genetic engineering**—ethics and security

To hear about Kimball Smith events:

- Go to our website (kimballsmithseries.yale.edu) and **sign up for the mailing list**, there!
- Follow @kimballsmithseries on Instagram

Reach out to Talia Weiss (talia.weiss@yale.edu) and Lihao Yan (lihao.yan@yale.edu) with questions or suggestions.

Alice Kimball Smith *(PhD '36): Historian of the post-WWII Scientists' Movement.*

Graduate Theory Seminar

- Bi-weekly reading group on hep-th, hep-ph, cond-mat, biophysics, etc.
- Bi-semesterly lectures by senior students, postdocs, and faculty

SNACKS PROVIDED!

Contact us to be added to the mailing list

joseph.lap@yale.edu
xinping.yang@yale.edu
mark.gonzalez@yale.edu

Social gathering on the last Friday of every month!

Free food, snacks, alcoholic and non-alcoholic beverages

Current Happy Hour Crew

Devon Finlay devon.finlay@yale.edu

Jesse Farr jesse.farr@yale.edu


*let us know about any dietary restrictions!

in 2023-2024

Active

Growing

Developing a vision for the future!

Yale Physics