

The UVA Physics Bridge Program



Chris Neu
Professor of Physics
Physics Bridge Program Director

CSAAPT Meeting
JMU
1 April 2023

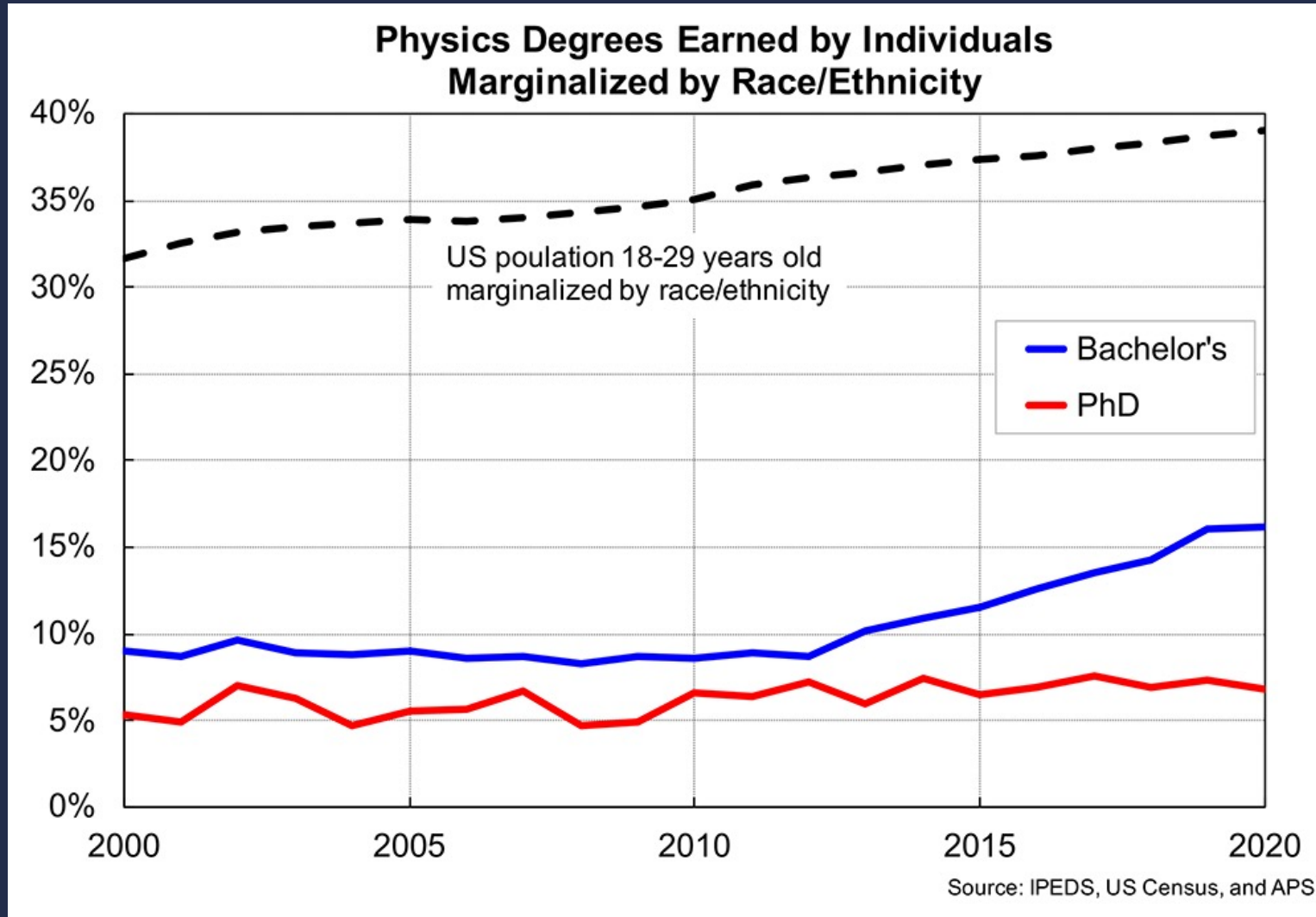
The UVA Physics Bridge Program

- In 2015, the Department of Physics at the University of Virginia instituted the PhysicsBridge program
 - Aimed towards increasing diversity in our graduate program.
- Overview:
 - A 2-year post-bacc program
 - Target student cohort:
 - Those from backgrounds under-represented in Physics
 - Who have demonstrated exceptional promise as young Physicists, either in classroom or in the lab,
 - But who could benefit from additional academic training, research experiences, and scientific skill development
 - Students receive a tailored academic curriculum and targeted research opportunities to bridge from their undergraduate to graduate experience
- Additional training optimizes their chance at success in their eventual pursuit of their PhD.



Motivation

<https://www.aps.org/programs/education/statistics/phdpopulation.cfm>

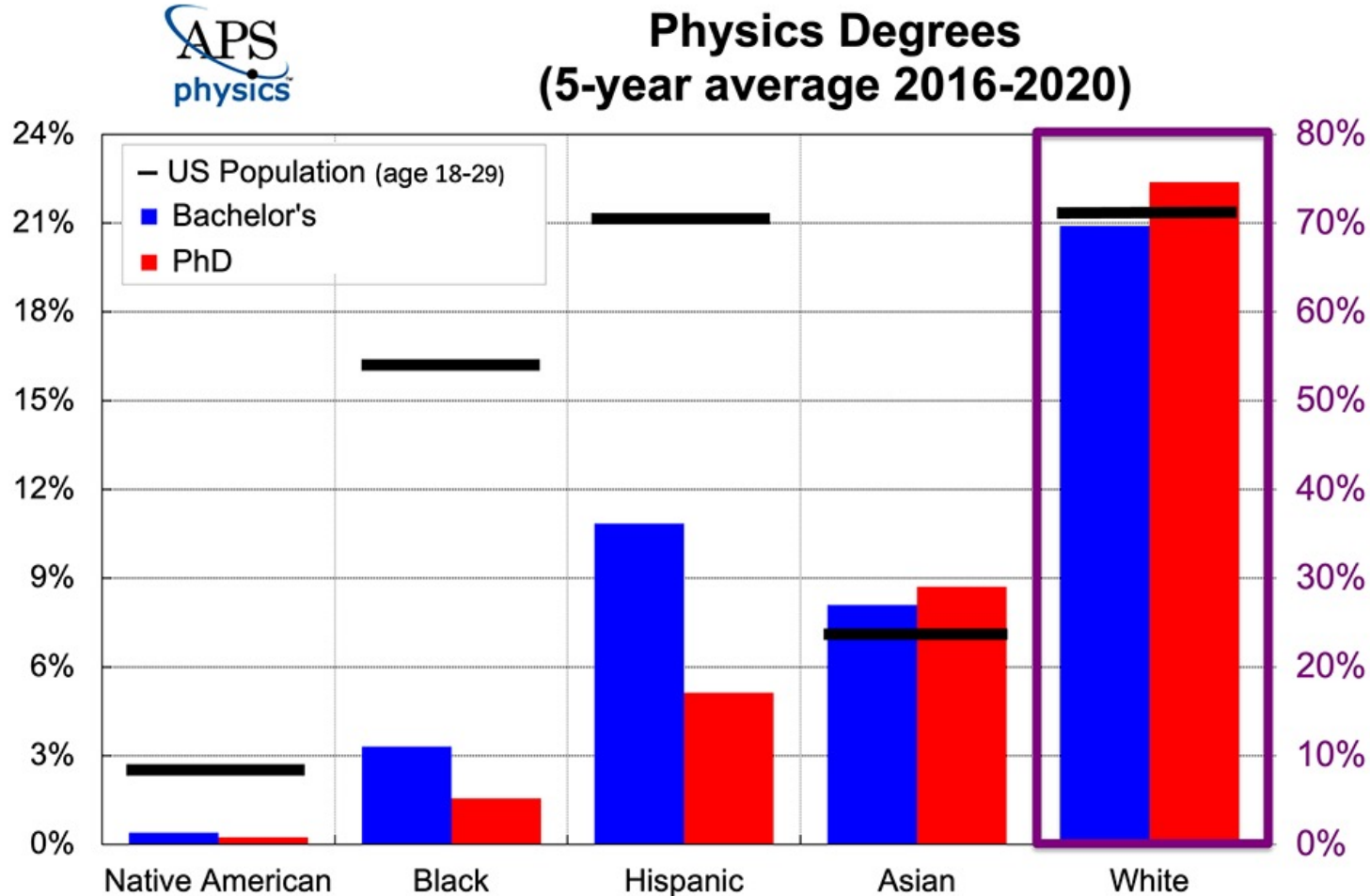


Race and Ethnicities here: African Americans, Hispanic Americans, American Indians, Alaska Natives, Native Hawaiians, and other Pacific Islanders.

- There is a loss of URM's into advanced physics
 - URM's are 16% of Bachelor's degree recipients in Physics
 - ...but are only 7% of PhD recipients
- One goal of Bridge programs like this one is to close this gap
- Another thing to note:
 - URM's represent 39% of the college age population
 - Yet only account for 16% of Bachelor's degrees in Physics
- This is another problem
 - Other initiatives are designed to directly increase the URM participation rates in Bachelor's degree programs
 - Impact of graduate initiatives can have a second-order effect on this gap as well

Motivation

<https://www.aps.org/programs/education/statistics/phdpopulation.cfm>



Source: IPEDS, US Census, and APS

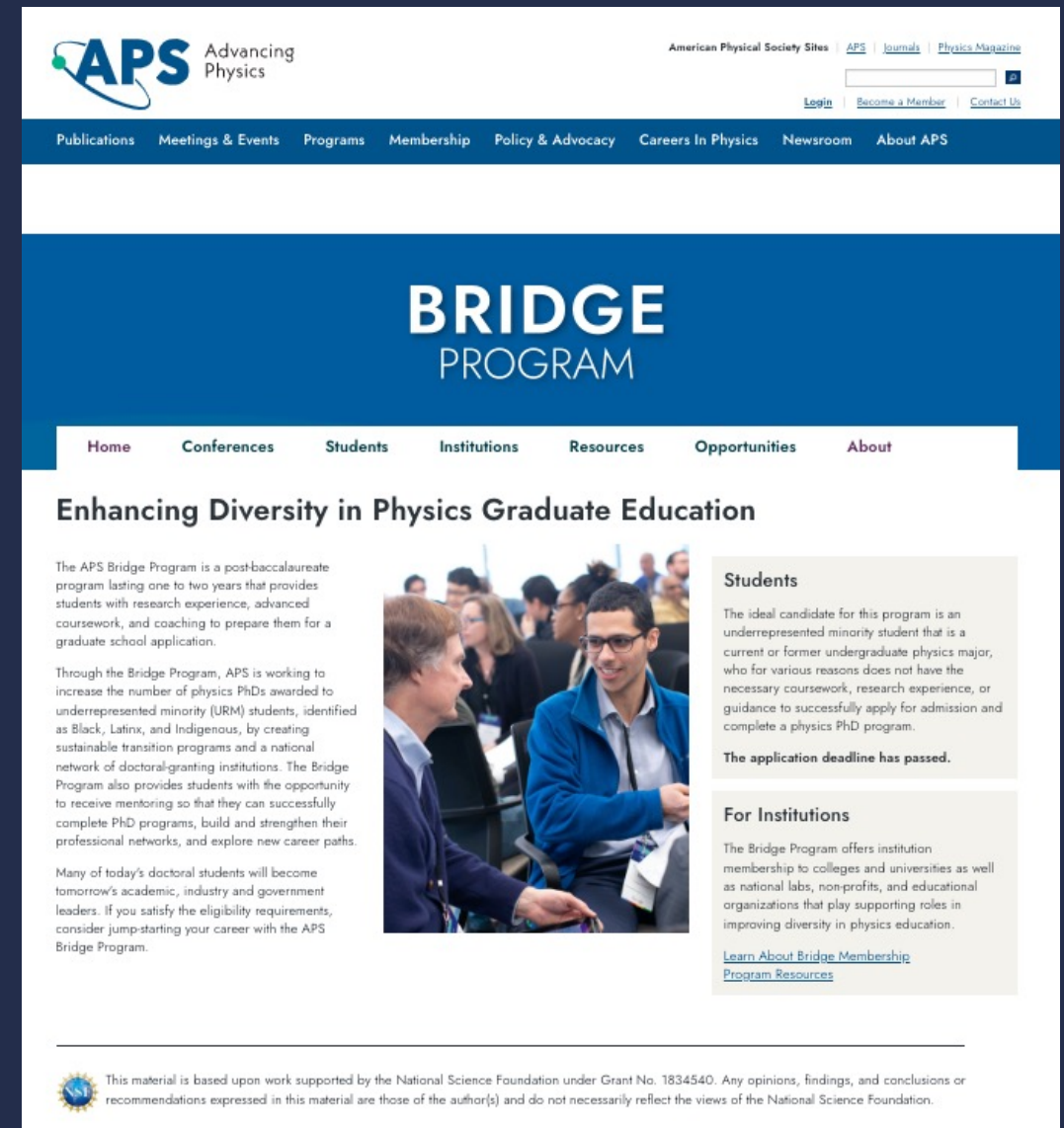
Note: black bars sum to >100% due to the effect of multiracial individuals appearing in each bin to which they belong.

- There is a loss of URM's into advanced physics
 - URM's are 16% of Bachelor's degree recipients in Physics
 - ...but are only 7% of PhD recipients
- One goal of Bridge programs like this one is to close this gap
- Another thing to note:
 - URM's represent 39% of the college age population
 - Yet only account for 16% of Bachelor's degrees in Physics
- This is another problem
 - Other initiatives are designed to directly increase the URM participation rates in Bachelor's degree programs
 - Impact of graduate initiatives can have a second-order effect on this gap as well

The Origin of UVA Physics Bridge

- UVA PhysicsBridge was originally built off the APS Bridge Program (APS-BP) initiative
 - Goals:
 - *Increase the fraction of physics PhDs awarded to underrepresented minority students to match the fraction of physics Bachelor's degrees granted to these groups*
 - *Develop, evaluate, and document sustainable model bridging experiences that improve the access to and culture of graduate education for all students, with emphasis on those underrepresented in doctoral programs in physics*
 - *Promote and disseminate successful program components to the physics community*

<https://www.aps.org/programs/minorities/bridge/index.cfm>



APS Advancing Physics

American Physical Society Sites | APS | Journals | Physics Magazine

Login | Become a Member | Contact Us

Publications Meetings & Events Programs Membership Policy & Advocacy Careers In Physics Newsroom About APS

BRIDGE PROGRAM


Home Conferences Students Institutions Resources Opportunities About

Enhancing Diversity in Physics Graduate Education

The APS Bridge Program is a post-baccalaureate program lasting one to two years that provides students with research experience, advanced coursework, and coaching to prepare them for a graduate school application.

Through the Bridge Program, APS is working to increase the number of physics PhDs awarded to underrepresented minority (URM) students, identified as Black, Latinx, and Indigenous, by creating sustainable transition programs and a national network of doctoral-granting institutions. The Bridge Program also provides students with the opportunity to receive mentoring so that they can successfully complete PhD programs, build and strengthen their professional networks, and explore new career paths.

Many of today's doctoral students will become tomorrow's academic, industry and government leaders. If you satisfy the eligibility requirements, consider jump-starting your career with the APS Bridge Program.



Students

The ideal candidate for this program is an underrepresented minority student that is a current or former undergraduate physics major, who for various reasons does not have the necessary coursework, research experience, or guidance to successfully apply for admission and complete a physics PhD program.

The application deadline has passed.

For Institutions

The Bridge Program offers institution membership to colleges and universities as well as national labs, non-profits, and educational organizations that play supporting roles in improving diversity in physics education.

[Learn About Bridge Membership Program Resources](#)

This material is based upon work supported by the National Science Foundation under Grant No. 1834540. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

UVA and APS-BP

- Institutions working with APS-BP have a certain status:
 - **Membership Institutions:**
 - These benefit from advisory support aspects of APS-BP
 - Laying groundwork for access to APS-BP candidate pool
 - **Partnership Sites:**
 - A master's or doctoral granting institution that has received Bridge Program approval and is committed to providing transitional support for APS Bridge Fellows entering these programs.
 - Access to APS-BP candidate pool for admissions into program
 - **Bridge Sites:**
 - A master's or doctoral granting institution that has devised a program that prepares students to apply and be accepted into a physics doctoral program.
 - Access to APS-BP candidate pool for admissions into program

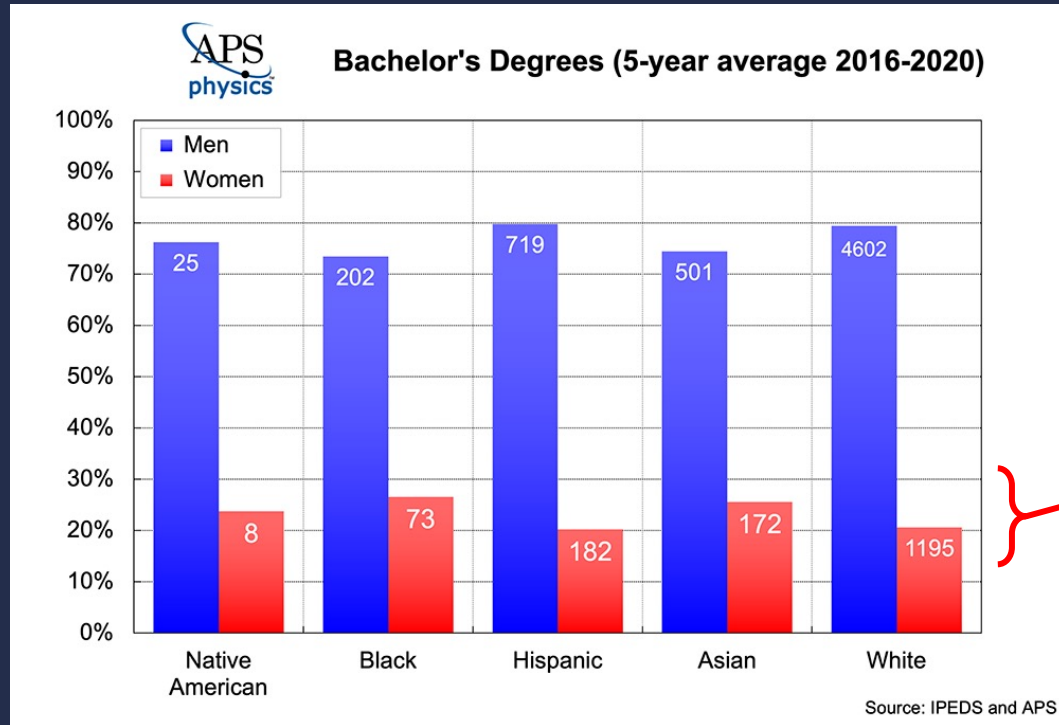
APS Bridge & Partnership Sites

**Bridge sites*

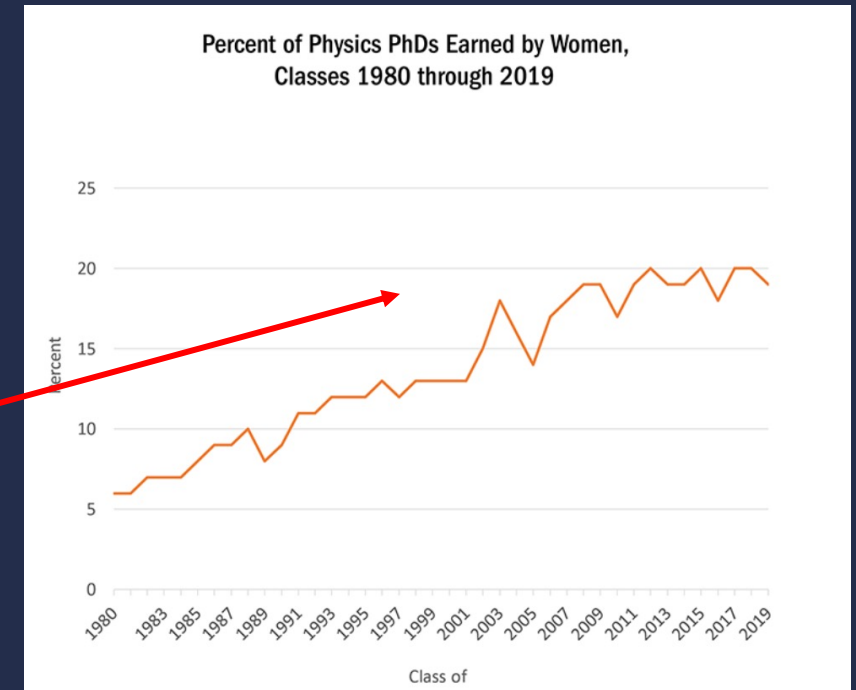
- | | |
|--|---|
| ■ Bowling Green State University | ■ University of Central Florida* |
| ■ California State University Long Beach* | ■ University of Chicago |
| ■ California State University, Los Angeles | ■ University of Cincinnati |
| ■ Case Western Reserve University | ■ University of Colorado Boulder |
| ■ Columbia University | ■ University of Connecticut |
| ■ Delaware State University | ■ University of Hawai'i at Manoa |
| ■ DePaul University | ■ University of Illinois at Urbana-Champaign |
| ■ Embry-Riddle Aeronautical University | ■ University of Iowa |
| ■ Fisk-Vanderbilt | ■ University of Kansas |
| ■ Florida International University | ■ University of Kentucky |
| ■ Florida State University* | ■ University of Michigan |
| ■ Illinois Institute of Technology | ■ University of Minnesota |
| ■ Indiana University* | ■ University of North Carolina at Chapel Hill |
| ■ MIT | ■ University of Pennsylvania |
| ■ North Dakota State University | ■ University of Pittsburgh |
| ■ Princeton University | ■ University of Rochester |
| ■ Rensselaer Polytechnic Institute | ■ University of Texas at Arlington |
| ■ Syracuse University | ■ University of Texas at Austin |
| ■ Texas State University | ■ University of Texas at San Antonio |
| ■ The Ohio State University* | ■ University of Virginia |
| ■ The University of Alabama | ■ West Virginia University |
| ■ University of California, Davis | ■ Wright State University |
| ■ University of California, Irvine | |
| ■ University of California, Los Angeles | |
| ■ University of California, Santa Barbara | |

UVA Physics Bridge: Beyond Just URM's

<https://www.aps.org/programs/education/statistics/gender-race-eth.cfm>



<https://www.aip.org/statistics/reports/trends-physics-phds-171819>

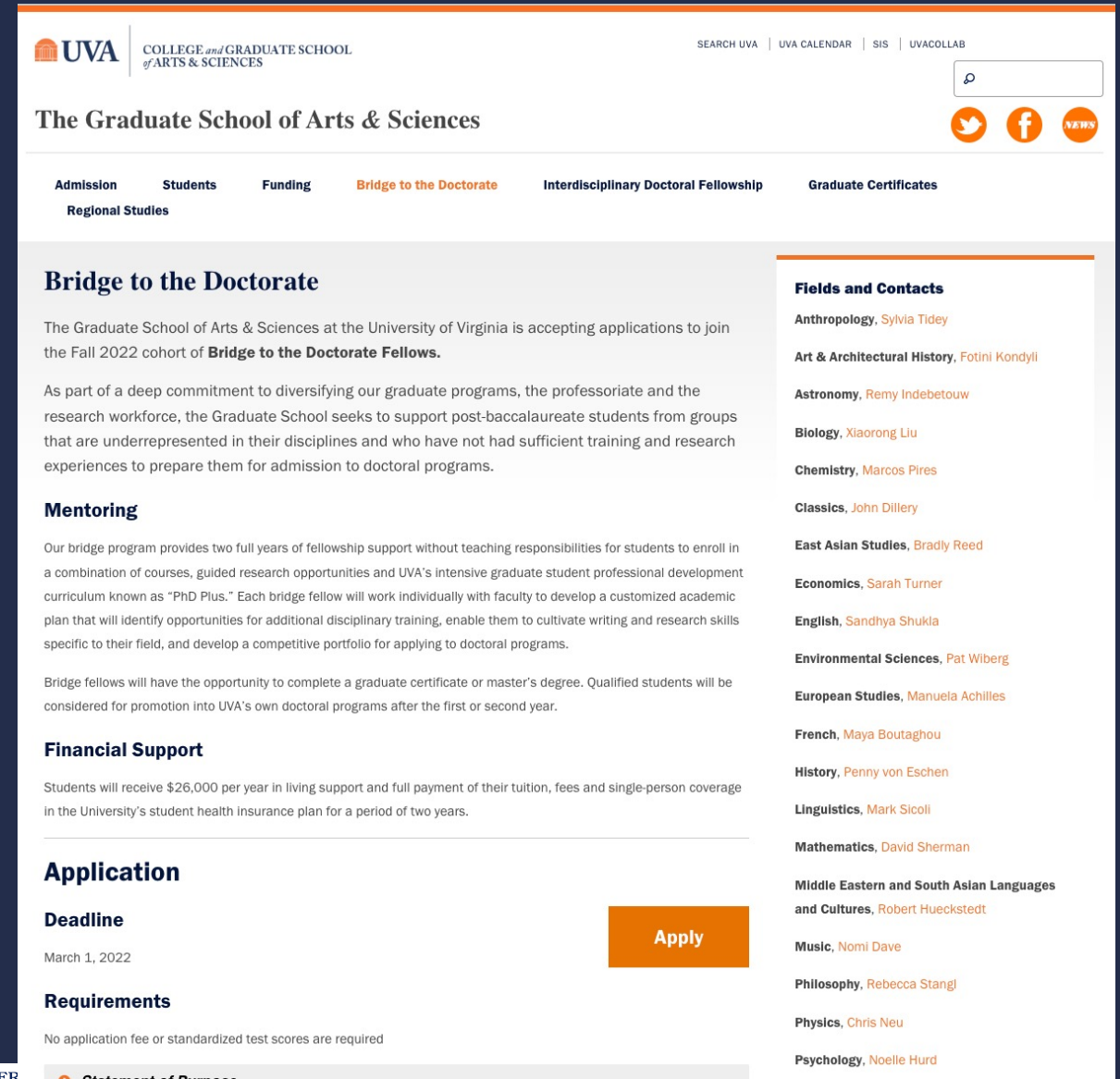


- Further in UVA Physics, we have made a dedicated commitment to recruiting and retaining another significantly under-represented group in the academy: **female Physics students**
 - The female fraction of degree recipients in PhD programs has improved in the last 15 years, achieving near parity with the female fraction of Bachelor's recipients
 - BUT the overall female fraction receiving these degrees (~20%) is woefully deficient when compared to the general population (~51% of those attending college).
 - Additional female participation in advanced Physics could have a trickle-down effect in increasing female participation in Physics generally

Logistics of UVA Physics Bridge

- Since the inception of the program, support for PhysicsBridge students has come from two sources:
 - Departmental funds, as available, since 2016.
 - The [UVA Bridge To Doctorate Fellows program](https://graduate.as.virginia.edu/bridge-doctorate) (B2D), started in 2020.
 - UVA A&S initiative open to students from all programs
 - Physics Bridge was a model that UVA used when launching this program
- Benefits include:
 - Two full years of fellowship support (full tuition, fees, health coverage, stipend)
 - Individualized academic curriculum
 - Guided research opportunities
 - Access to *PhD Plus* - UVA's intensive graduate student professional development program

<https://graduate.as.virginia.edu/bridge-doctorate>



The screenshot shows the official website for the UVA Bridge to the Doctorate program. The header includes the UVA logo, the College and Graduate School of Arts & Sciences name, and navigation links for Search UVA, UVA Calendar, SIS, and UVA Collaborative. A search bar is present on the right. Below the header, a navigation menu lists various programs, with 'Bridge to the Doctorate' highlighted in orange. The main content area is titled 'Bridge to the Doctorate' and contains several sections: 'The Graduate School of Arts & Sciences at the University of Virginia is accepting applications to join the Fall 2022 cohort of Bridge to the Doctorate Fellows.', 'As part of a deep commitment to diversifying our graduate programs...', 'Mentoring' (describing the PhD Plus program), 'Financial Support' (detailing the \$26,000 per year stipend), and 'Application' (with a deadline of March 1, 2022, and a list of requirements). A large orange 'Apply' button is prominently displayed. On the right side, there is a 'Fields and Contacts' section listing various academic fields and their corresponding faculty members, such as Anthropology (Sylvia Tidey), Art & Architectural History (Fotini Kondyli), and Physics (Chris Neu).

UVA COLLEGE and GRADUATE SCHOOL of ARTS & SCIENCES

SEARCH UVA | UVA CALENDAR | SIS | UVACOLLAB

The Graduate School of Arts & Sciences

Admission Students Funding **Bridge to the Doctorate** Interdisciplinary Doctoral Fellowship Graduate Certificates Regional Studies

Bridge to the Doctorate

The Graduate School of Arts & Sciences at the University of Virginia is accepting applications to join the Fall 2022 cohort of **Bridge to the Doctorate Fellows**.

As part of a deep commitment to diversifying our graduate programs, the professoriate and the research workforce, the Graduate School seeks to support post-baccalaureate students from groups that are underrepresented in their disciplines and who have not had sufficient training and research experiences to prepare them for admission to doctoral programs.

Mentoring

Our bridge program provides two full years of fellowship support without teaching responsibilities for students to enroll in a combination of courses, guided research opportunities and UVA's intensive graduate student professional development curriculum known as "PhD Plus." Each bridge fellow will work individually with faculty to develop a customized academic plan that will identify opportunities for additional disciplinary training, enable them to cultivate writing and research skills specific to their field, and develop a competitive portfolio for applying to doctoral programs.

Bridge fellows will have the opportunity to complete a graduate certificate or master's degree. Qualified students will be considered for promotion into UVA's own doctoral programs after the first or second year.

Financial Support

Students will receive \$26,000 per year in living support and full payment of their tuition, fees and single-person coverage in the University's student health insurance plan for a period of two years.

Application

Deadline

March 1, 2022

Requirements

No application fee or standardized test scores are required

Apply

Fields and Contacts

Anthropology, [Sylvia Tidey](#)

Art & Architectural History, [Fotini Kondyli](#)

Astronomy, [Remy Indebetouw](#)

Biology, [Xiaorong Liu](#)

Chemistry, [Marcos Pires](#)

Classics, [John Dillery](#)

East Asian Studies, [Bradly Reed](#)

Economics, [Sarah Turner](#)

English, [Sandhya Shukla](#)

Environmental Sciences, [Pat Wiberg](#)

European Studies, [Manuela Achilles](#)

French, [Maya Boutaghou](#)

History, [Penny von Eschen](#)

Linguistics, [Mark Sicoli](#)

Mathematics, [David Sherman](#)

Middle Eastern and South Asian Languages and Cultures, [Robert Hueckstedt](#)

Music, [Nomi Dave](#)

Philosophy, [Rebecca Stangl](#)

Physics, [Chris Neu](#)

Psychology, [Noelle Hurd](#)

Example Curricula

Student A:

- Taken a large portion of standard undergrad curriculum
- Needs to take 1 or 2 for the first time
- Wants to do theoretical astrophysics and cosmology

Fall Year 1:

Quantum Mechanics I – PHYS 3650
Statistical Physics – PHYS 3310
PDEs – MATH 4220
Computational Physics I – PHYS 5630

Spring Year 1:

Quantum Mechanics II – PHYS 3660
Electricity and Magnetism I – PHYS 3420
Intro to General Relativity – PHYS 5240
Mathematics for Physics – MATH 4210

Summer Year 1:

Independent Research – PHYS 7995/9998

Fall Year 2:

Graduate-level Electricity and Magnetism I - PHYS 7410
Quantum Theory I - PHYS 7610
Mathematical Methods of Physics I - PHYS 5250
Pre-Qual Preparation for Doctoral Research - PHYS 9998

Spring Year 2:

Statistical Mechanics - PHYS 7210
Electricity and Magnetism II - PHYS 7420
Quantum Theory II - PHYS 7620
Pre-Qual Preparation for Doctoral Research - PHYS 9998

Summer Year 2:

Independent Research – PHYS 9998

Example Curricula

Student B:

- Has not yet taken a full complement of undergrad curriculum
- Needs to revise foundational concepts, math background
- Has some research experience, wants to do experimental nuclear

Fall Year 1:

Scientific Computing – PHYS 2660
Widely Applied Physics – PHYS 3110
Intermediate Laboratory I – PHYS 3170
Ordinary Differential Equations – MATH 3250

Spring Year 1:

Modern Physics – PHYS 2620
Problem Solving in Physics – PHYS 2720
Classical Mechanics – PHYS 3210
Partial Differential Equations – MATH 4220

Summer Year 1:

Independent Research – PHYS 7995/9998

Fall Year 2:

Electronics Laboratory – PHYS 3150
Quantum Mechanics I – PHYS 3650
Statistical Physics – PHYS 3310
Intro to Nuclear and Particle Physics – PHYS 5720

Spring Year 2:

Math for Physics – PHYS 3340
Electricity and Magnetism I – PHYS 3420
Quantum Mechanics II – PHYS 3660

Summer Year 2:

Independent Research – PHYS 9998

Timeline and Outcomes

- Started with a pilot phase of the Bridge program:
 - June 2015:
 - UVA as APS-BP Member Site status
 - Aug 2016:
 - First 2 Physics Bridge students enroll
 - One received PhD in September 2022, one still in program
 - April 2017:
 - UVA Physics becomes an APS-BP Partner Site
 - August 2017:
 - Second 2 Physics Bridge students enroll
 - Both still in program
 - August 2018:
 - 4 Physics Bridge students enroll
 - Each left the program due to academic and/or personal issues
 - Triggered a pause to study our Bridge implementation
- Main focus of 2019-20:
 - Development of Physics Bridge program into a mature part of our departmental offerings
- Since 2020, aligned Physics Bridge with UVA B2D Fellows program
 - August 2020: Enrolled 3 fellows in first B2D cohort
 - August 2021: Enrolled 2 B2D fellows
 - August 2022: Enrolled 3 B2D fellows

Outcomes: Small statistics so far

- 16 total Physics Bridge students over 7 academic years
 - 5 left the program for academic or personal reasons
 - 5 are currently taking academic classes
 - 1 is on medical leave, returning for MS in Fall
 - 3 are in PhD program with target degree dates in 2024-26
 - 1 is in PhD program looking to defend in Fall 2023
 - 1 has received their PhD (Sept 2022)
- Each from a background under-represented in Physics.

Lessons Learned and Best Practices

- An inclusive, welcoming environment is essential
 - We strive to nurture that environment at UVA, listening to our students
- Need to recognize unique needs frequently exhibited by under-represented students
 - Students from these groups can feel isolated, given their under-represented status
 - Many are first-generation college students who have fewer experts to turn to for guidance in navigating college and graduate level study
- Students need a strong support network -- academic, scientific, social -- and need to be integrated into the department, university and local communities
 - We use the multiple mentoring formation to intentionally broaden a student's network
- Bridge students take advanced undergraduate courses -- but have not matriculated in the ladder course structure with the other students, many of whom have known each other since first semester, first year
 - Adds to feelings of isolation
- Departmental support is essential
 - Chair needs to be a visible supporter of the program
 - Need faculty and staff who are sensitive to the unique needs of students from under-represented backgrounds
- Need to balance flexibility in the program with well-defined policies
 - Transparency in expectations and responsibilities is a good practice universally, but especially for people who feel vulnerable or are dealing with doubts about belonging

Logistics of UVA Physics Bridge

- Since the inception of the program, support for PhysicsBridge students has come from two sources:
 - Departmental funds, as available, since 2016.
 - The [UVA Bridge To Doctorate Fellows program](https://graduate.as.virginia.edu/bridge-doctorate) (B2D), started in 2020.
 - UVA A&S initiative open to students from all programs
 - Physics Bridge was a model that UVA used when launching this program
- UVA PhysicsBridge students receive
 - Two years of Fellowship support to allow full focus on reinforcing academic foundations
 - Individualized curriculum best suited to meet their unique educational needs based off a skills assessment taken in summer before program begins
 - Academic and institutional mentoring from the PhysicsBridge Director
 - A second faculty mentor who works in a research area aligned with the student's interest
 - Guided research opportunities, typically starting in the summer after their first year in the program
 - A support network of Bridge students and mentors from departments throughout the College
 - Plus full access to student support networks throughout the university (PhDPlus, CAPS, etc)

<https://graduate.as.virginia.edu/bridge-doctorate>

The screenshot shows the official website for the Bridge to the Doctorate program at the University of Virginia. The header includes the UVA logo, the College and Graduate School of Arts & Sciences name, and navigation links for Search UVA, UVA Calendar, SIS, and UVACollab. A search bar is present on the right. Below the header, a navigation menu lists various programs: Admission, Students, Funding, Bridge to the Doctorate (highlighted), Interdisciplinary Doctoral Fellowship, and Graduate Certificates. The main content area is titled 'Bridge to the Doctorate' and contains a paragraph about the program's purpose, a 'Mentoring' section, and a 'Financial Support' section. On the right side, there is a 'Fields and Contacts' sidebar listing various academic fields and their corresponding faculty members. At the bottom, there is an 'Application' section with a 'Deadline' of March 1, 2022, and a large orange 'Apply' button. The footer includes the University of Virginia logo and a link to the 'Statement of Purpose'.

The Graduate School of Arts & Sciences

Bridge to the Doctorate

The Graduate School of Arts & Sciences at the University of Virginia is accepting applications to join the Fall 2022 cohort of **Bridge to the Doctorate Fellows**.

As part of a deep commitment to diversifying our graduate programs, the professoriate and the research workforce, the Graduate School seeks to support post-baccalaureate students from groups that are underrepresented in their disciplines and who have not had sufficient training and research experiences to prepare them for admission to doctoral programs.

Mentoring

Our bridge program provides two full years of fellowship support without teaching responsibilities for students to enroll in a combination of courses, guided research opportunities and UVA's intensive graduate student professional development curriculum known as "PhD Plus." Each bridge fellow will work individually with faculty to develop a customized academic plan that will identify opportunities for additional disciplinary training, enable them to cultivate writing and research skills specific to their field, and develop a competitive portfolio for applying to doctoral programs.

Bridge fellows will have the opportunity to complete a graduate certificate or master's degree. Qualified students will be considered for promotion into UVA's own doctoral programs after the first or second year.

Financial Support

Students will receive \$26,000 per year in living support and full payment of their tuition, fees and single-person coverage in the University's student health insurance plan for a period of two years.

Application

Deadline

March 1, 2022

Requirements

No application fee or standardized test scores are required

Fields and Contacts

- Anthropology, [Sylvia Tidey](#)
- Art & Architectural History, [Fotini Kondyli](#)
- Astronomy, [Remy Indebetouw](#)
- Biology, [Xiaorong Liu](#)
- Chemistry, [Marcos Pires](#)
- Classics, [John Dillery](#)
- East Asian Studies, [Bradly Reed](#)
- Economics, [Sarah Turner](#)
- English, [Sandhya Shukla](#)
- Environmental Sciences, [Pat Wiberg](#)
- European Studies, [Manuela Achilles](#)
- French, [Maya Boutaghou](#)
- History, [Penny von Eschen](#)
- Linguistics, [Mark Sicoli](#)
- Mathematics, [David Sherman](#)
- Middle Eastern and South Asian Languages and Cultures, [Robert Hueckstedt](#)
- Music, [Nomi Dave](#)
- Philosophy, [Rebecca Stangl](#)
- Physics, [Chris Neu](#)
- Psychology, [Noelle Hurd](#)

[Apply](#)

[Statement of Purpose](#)

Summary

- The UVA Physics Bridge program, now in its 8th year, is an initiative designed to increase diversity in our graduate program.
- The Physics Bridge program targets promising students in Physics that could benefit from additional academic preparation, research training or professional skill development.
- This initiative has enrolled 16 students since 2015, each from a background under-represented in Physics.
- The first UVA Physics Bridge student to receive their PhD successfully defended in September 2022, and others are making strong, steady progress towards their degree.

For more information, see <https://www.phys.virginia.edu/PhysicsBridge/>
or email [UVA PhysicsBridge Director Chris Neu](mailto:Chris.Neu@uvastudent.org)