APS physics | National Mentoring Community

Conversations

NEWSLETTER OF THE APS NATIONAL MENTORING COMMUNITY

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APS National Mentoring Community Conference participants at the University of Houston.

2016 National Mentoring Community Conference Highlights

ARLENE MODESTE KNOWLES *APS Diversity Programs Coordinator*

The second APS National Mentoring Community (NMC) Conference took place at the University of Houston, October 21-23, 2016. This conference brought together more than 110 NMC Mentors, NMC Mentees, administrators and others for a weekend of talks, workshops, networking, and even a bit of planned fun.

The NMC Conference is an important component of the larger NMC Program, which has the goal of increasing the number of underrepresented racial and ethnic minority students who obtain physics undergraduate degrees. It does so by providing students with mentors to help them navigate their undergraduate degrees and by supporting those relationships with resources, training, opportunities, and funding.

The first plenary of the conference was given by Dr. Frances Carter-Johnson, a data scientist at the National Science Foundation. In addition to her physics and applied physics degrees, Carter-Johnson holds a PhD in public policy and has researched so-

cio-cognitive factors and programming that support broadening participation in physics and STEM fields. Her talk, peppered with information on mentoring research and success strategies, also touched on her personal experiences of being mentored and mentoring graduate and undergraduate students.

Prof. Mary James, Dean for Institutional Diversity & Professor of Physics at Reed College, stepped in for the second year in a row to impart sage advice and substantial information on improving diversity in physics. The topic of her wonderful talk was what faculty must do to cultivate future scientists with diverse backgrounds. She noted that it is the faculty member's job to lead the student on the path from novice to expert and that students, particularly women and minorities, often travel that path with the added burdens of imposter syndrome, stereotype threat, belongingness uncertainty, and the belief in fixed mindsets.

A new addition to the program this year was the Research Experiences for Undergraduates/Graduate School Program fair. Fifteen institutions hosted tables to share information about their undergraduate research and graduate programs with students and faculty. This was an opportunity for students to learn about the research at several institutions at once. They also had a chance to pick up some fun swag.

The undergraduate poster session was one of the major highlights of the conference and had twenty-two student presenters this year – up from eight undergraduate posters last year. This professional development component allowed students to practice presenting their research in a friendly environment, where they received constructive feedback from practicing physicists. It also afforded them an opportunity to learn about the research performed by their peers. Several judges commented that overall, the poster presentations were well done. The top poster prize went to Madelyn Leemburgen from the University of Cincinnati, whose poster was on the *Collapse of Axion Stars*; and the second prize went to Brianna Galgano from Vanderbilt University on the *Determination of M and K dwarf effective Temperature, Radius, Mass and Metallicity Using a Data-driven Spectral Model by the Cannon*.

Prof. Gabriela Gonzalez, LSU Professor of Physics and Spokesperson for the LIGO project, gave a riveting talk about the long-anticipated detection of gravitational waves that rocked the physics world this year; 100 years after Einstein's prediction. Gonzalez captivated the audience as she conveyed the drama of the first uncertain moments of the initial detection, the gift of the second detection, the intense work it took to prove that the scientists had indeed detected gravitational waves, and the implications of

Dr. Gabriela Gonzalez, LSU & LIGO Spokesperson, shares the excitement of discovering gravitational waves.

l. to r. - 1st Place Undergraduate Poster Prize winner, Madelyn Leembruggen, University of Cincinnati, and APS Committee on Minorities chair, Prof. Nadya Mason, UIUC

Background: NMC Mentor Mani Tripathi, UC Davis; Foreground: APS President Homer Neal, University of Michigan

NMC students identifying their skills during the career worksop. l. to r. - Christian Garcia, Stephanie Morris, and Khalil McMillan.

Dr. Richard Baker, UH, gives talk on harassment. Foreground - NMC Mentor, Ben Hooberman, UIUC.

that scientific breakthrough. She even circled back around to the history of the LIGO project, where many students are currently mentored and spoke about the importance of her mentors to her career success.

Like last year, the Conference had separate trainings for research mentors and mentees on improving their mentoring relationships and their effectiveness. In the career workshops, students learned how to develop their skills-based resumes to help them stand out among jobseekers, while faculty learned about careers outside of academia and how to effectively prepare their students for the STEM workforce.

The newest and possibly most unique workshops offered at any physics conference were those on race and sexual harassment. On Sunday morning, the students and faculty split up into two separate workshops focusing on race. Dr. Angela Little, Dr. Chandra Turpen, and Prof. Jesús Pando introduced a workshop for faculty to understand and reflect on issues of race and racism often faced by physics students, and begin developing strategies for mitigating those experiences in their roles as mentors. Meanwhile, during a workshop led by University of Colorado, Boulder graduate students, Wagma Mommandi and Simone Hyater-Adams, students shared their own painful experiences of racism with one another and found commonalities among them. Mommandi and Hyater-Adams shared strategies with students to counteract the effects of the isolation, anger, and myriad negative emotions they feel from encountering racism on a regular basis. Following those workshops, Dr. Richard Baker, the Title IX officer at the University of Houston, gave an incredibly engaging talk on sexual harassment and abuse: how it's defined, what it looks like, what faculty could and should do regarding student reporting, and of what students should be aware.

Finally, the conference participants themselves shared their best practices for mentoring and being mentored, which will be disseminated to all NMC Program participants in the future. Based on the

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Special Thanks:

The APS would like to thank the University of Houston and specifically UH Provost & Senior Vice Chancellor of the UH System, Dr. Paula Myrick Short for graciously supporting the NMC Conference. We would also like to thank certain individuals without whom the meeting would not have been a success. We thank Dr. Erika Henderson for facilitating the logistics within the UH system, Dr. Larry Pinksy for his logistical guidance and help arranging the NASA tour, Dr. Donna Stokes for organizing the student volunteers, and the physics department, including Jennifer Chin Davis and Jackie Owens. A special thank you to all of the UH student volunteers, namely, Tristan Bennett, Axel Morain, Sam Garcia, Jaeylyn Kelly Daisy Nsibu, Henry Rodriguez, Aaron Ryan, Eric Sierra, Marissa Soto and any other UH students who helped us with registrations, getting attendees to the shuttles, tours, and bowling. Finally, we appreciate the facilities staff, AV students and staff, and the Cullen Catering staff, particularly Denise.

NMC Mentor – Mentee Spotlight

CARLISLE WOODARD *APS*

When NMC mentee Grayson Perez first met NMC mentor Mary James, attending Reed College was just one of many possibilities for the aspiring physics student. After being admitted to Reed, Grayson visited the Oregon campus in the hopes of gathering information about the various physics and interdisciplinary majors the college had to offer. The admissions office at Reed put Grayson in contact with Mary, the college's Dean for Institutional Diversity. To Grayson's surprise, Mary invited him to her office to answer his questions and discuss his future at Reed. After the discussion, Mary asked Grayson to be her NMC mentee and, now fully committed to attending Reed College in the fall, Grayson readily agreed.

We asked Mary James and Grayson Perez to share their thoughts about the mentoring relationship they have established and the NMC Program thus far.

NMC MENTOR

Mary James

Dean for Institutional Diversity, Reed College and A.A. Knowlton Professor of Physics

NMC Program: How have you structured your relationship?
Mary James: Grayson and I meet at least once a semester to go over his course schedule and schedule another check-in meeting shortly after the semester begins. We schedule additional meetings as often as he would like in order to discuss his interests and to answer his questions. We've talked about summer research internships, his desire to spend time in Puerto Rico where he has extended family, and his aspirations to go to graduate school in physics. Although Grayson has not yet taken a formal course in quantum mechanics, we met once this summer to talk about some fundamental concepts in order to prepare him for his summer internship.

NMC Program: How do you see your role as Grayson's mentor?
James: In addition to acting as his academic advisor, I help him to explore opportunities for summer research internships, as well as to begin to think about his long-term future.

NMC Program: What are the benefits of a mentor/mentee relationship?
James: Grayson is so excited to be at Reed and so excited to study physics. He has such promise as a young scientist. It's a pleasure and an honor to act as his guide through this unfamiliar terrain.

NMC Program: What advice would you give to mentors or mentees?
James: Ask a lot of questions of one another. I would remind mentors to make it clear that you are interested in helping the student resolve any problems that may interfere with their academic progress, even if the problem itself is not academic. Don't assume your mentee knows how to be their own advocate. Self-advocacy is a skill that you may need to nurture in your mentee. Model good self-advocacy by walking your mentee through the solutions to a few problems. Slowly encourage them to take on more of the problem-solving steps on their own. Have them check back with you often as they take the steps in solving the problem.

I would encourage the mentees to come to each meeting with a question. How do I find a summer internship? I have to help my family look after younger siblings in the evenings. Is it possible to get a summer internship in my hometown? Can I take quantum mechanics before I take linear algebra? Even if I can, is it a good idea? Your mentor may not have all the answers, but they can point you toward the right resources to help you get the answers you need.

Prof. Mary James, Reed College (middle) with NMC Mentees, Grayson Perez (left), and Elizabeth Arellano (right)

NMC MENTEE

Grayson Perez

Physics major, Reed College

NMC Program: How have you structured your meetings?
Grayson Perez: Our meetings progress very naturally. They are informal and we do not have strict topics of discussion. Generally the process of making a meeting begins when, about once a month, I realize that I have a question for Mary. I then go to her office and we work out a convenient time to meet (usually within twenty-four hours). Once the meeting starts, Mary asks about my wellbeing and the progress of my classes. Then we discuss my questions.

NMC Program: What do you like about the structure of your relationship and what do you consider to be a challenge?
Perez: I like this structure because it is time efficient and every meeting results in new, useful information. One challenging aspect of our structure is that I have to be very independent. While some stu-

dents may prefer the security of an adviser who tells them what to do, my relationship with Mary is not like that. Still, I feel comfortable knowing that if I start to go down the wrong path, Mary would be there to advise me.

NMC Program: What do you think your responsibilities are as a mentee?
Perez: As a mentee, it is my responsibility to respect my mentor's time. I also believe that since Mary has an investment in my success, I have a responsibility to keep her updated on my progress. If I receive a special opportunity or I realize that I am struggling, it is my responsibility to keep Mary informed.

NMC Program: What are the benefits of a mentor/mentee relationship?
Perez: Mentors have access to the broader physics community, which can be hard to access as a student first entering the field. Because of the NMC, there is a larger focus on introducing young physicists to the community. This encourages young physicists to continue with their studies. Before I attended the first NMC conference in Miami, I was feeling discouraged about my future in physics. At that point, I had not taken a physics course in over a year and I was worried that I would not be successful in the field.

Attending the NMC conference helped me realize that my worries were a sign of Impostor Syndrome. Being around other people with similar concerns made a future in physics seem more possible. The exposure to people at all stages of their careers gave me a clear view of the path I was choosing.

NMC Program: What advice would you give to other mentees?
Perez: Remember why you first wanted to study physics. Your mentor is there to channel your passion and put it to use in a constructive way. When I am worried about my progress, Mary and I sit down and work out a four-year plan. Mary's advice makes me feel much more secure. ■

Society Task Force Releases Report on Career Preparation

THEODORE HODAPP *APS Director of Project Development and Senior Advisor to the Education and Diversity Department*

"Physicists can do anything" – a common sentiment among faculty that reflects both our sense of the power of physics problem solving skills, and our naïveté or worse, arrogance concerning what is actually done in the workplace. Yes, education in physics does provide an individual with highly flexible skills in mathematics, computers, spatial awareness, data analysis, and problem solving, but finding a job or marketing those skills can be daunting to a new graduate. What's more, the careers being sought by students today often do not match the skills provided in a very general physics education. According to the American Institute of Physics, the most common word in a new graduate's title is "engineer," and only about 13% of all graduates complete a PhD in physics, with less than a third of those ending up as academics – the one profession faculty know something about actually takes fewer than 1 in 20 of our majors. We owe it to our students to improve their preparation for the working world.

To address the disconnect between what is currently taught, and what our students actually use, the American Physical Society and American Association of Physics Teachers formed a Joint Task Force on Undergraduate Physics Programs[1] in 2014 to generate a report that would answer the question: *"What skills and knowledge should the next generation of undergraduate physics degree holders possess to be well prepared for a diverse set of careers?"* The report, published fall 2016, draws from the experience of private- and public-sector physicists as well as model programs across the US that have confronted this issue for their students. The report makes recommendations to faculty on how to set specific learning goals for their students that correspond to skill sets needed in today's workplace.

Some of these skills are easy to consider such as knowledge of general purpose modeling software like MATLAB, experimental skills involving common instrumentation, and understanding the limitations of these instruments. The report probes further by discussing the need to understand how project budgeting and management is advanced, how to communicate complex ideas, how to design experiments or simulations to test assumptions or designs, how to perform literature searches related to evaluating problems, and how to design solutions for applications, whether this is the optics on a spacecraft or a new pedagogical technique in a high school classroom.

It is the aim of the task force to promote the concepts contained in the report and the strategies outlined to effect sustainable changes to the current paradigm of physics education. A goal that will ultimately provide physics graduates with skills that will better prepare them for the rapidly evolving workplace – not just the one that their professors know well. ■

[1] Joint Task Force on Undergraduate Physics Programs: https://www.aps.org/programs/education/undergrad/jtupp.cfm

Preparing Physics Majors for Jobs in Industry

BEN ZWICKL, ANNE LEAK, AND KELLY MARTIN *Rochester Institute of Technology*

Although physics is a core part of science and engineering, physics programs are not highly aligned with a specific occupation or industry as engineering and computer science are. Much like a liberal arts education, physics provides a general foundation about how to think, but equips students with a rich quantitative toolbox, an understanding of fundamental principles, and a desire to understand why and how stuff works. Physics majors pursue a diverse range of careers with their degree, and rarely are those jobs titled "Physicist." American Institute of Physics data from classes of 2011-12 indicates that over 40% of Bachelors recipients entered the workforce and did not attend a graduate or professional school, and some of the most common jobs for physics majors involved engineering, software development, data analysis, and research and technical jobs.

> Physics majors pursue a diverse range of careers with their degree, and rarely are those jobs titled "Physicist."

Because career pathways for physics majors are diverse, mentors and physics departments must be proactive in making sure students know their options. Departments may need to coordinate with career services to verify the career counselors understand the jobs that physics majors are well-qualified for. Career services are often able to support the larger enrollment majors, like engineering, but physics tends to be smaller and can be overlooked by recruiters visiting campus. In our own institution we have a large career fair, but it takes direct encouragement and support with individual students to make sure they attend the career fair. Email blasts aren't enough to prompt students to take advantage of these options but 1-1 mentoring can work.

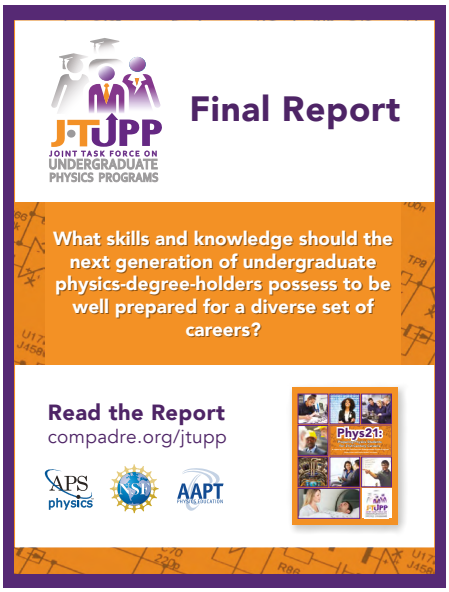
Although industry jobs vary widely, there are some common ways that the workplace differs from the typical physics curriculum. Many jobs involve designing software or engineering products. The design process can be unfamiliar to students. Computer programming and specialized software are ubiquitous. Some of these computational skills may be on the periphery of the undergraduate curriculum, but they are common and essential for jobs. Jobs often involve working on complex, collaborative, long-term projects, whereas the bulk of undergrad coursework involves lots of short, but challenging individual problems. Physics majors rarely work on technical problems that involve budgets, materials, clients, scaling, and communication as key factors to solving problems; though these are critical to most jobs in industry. Open-ended projects and well-chosen elective courses outside of physics may be helpful ways to introduce students to some of these topics.

A good way to expose students to workplace norms is to help students get co-ops or internships. These experiences can provide STEM-related paid work, connect students with professionals in a field they might pursue, and can help motivate students in their coursework. The co-op is also an opportunity to apply physics knowledge in a real-world setting and practice professional skills needed after graduation. Students may be unaware that co-ops are available, or don't see the value, so again proactive mentoring and connecting students with opportunities is essential. The pursuit of a co-op or a research experience can be challenging, there may be setbacks, failures, uncertainty, but the presence of a mentor can make a huge difference in keeping students moving forward.

Want to keep learning after graduation? Get a job!

Many STEM jobs are filled by STEM majors who did not earn a degree that specifically aligns with their job. This is true of almost all bachelor's physics majors working in industry, and it emphasizes that a lot of learning happens on the job. Graduate school isn't the only place to keep on learning, which could be a valuable reminder for students who see many of their classmates immediately pursuing graduate study.

Undergraduate-level physics content knowledge is only part of the story. Because the core knowledge used in research or industry varies widely between labs or companies, there is little chance a physics department can anticipate or prepare students for all possible careers. Students need to be ready to learn when they get to the job in order to fill in any gaps. Beyond the traditional physics content, such as mechanics and electricity and magnetism, there is a suite of transferrable skills that students need. Transferable technical skills include programming, data analysis, hands-on skills, measurement techniques, and mathematical modeling. Transferable soft skills include things like teamwork, asking questions, making presentations, documenting, communicating interpersonally across contexts, and self-directed learning. These transferable skills



often stand out to employers more than the specific content knowledge. The SPS Career Toolbox [1] advises students to do a skill-centered resume to forefront these transferable skills when pursuing jobs.

What skills do employers say are super-relevant to on-the-job success? Work ethic and good communication skills tend to be just as relevant as technical expertise [2]. The physics GPA is weighted toward performance in theory classes, but the mathematical and physics acumen on display represents only a portion of what makes students successful on the job. A bachelor's degree in physics is a good indicator of technical competency, while the interview process provides an evaluation of soft skills, such as interpersonal communication. When mentoring students, take a broad look at where they excel and where they could use additional help.

Students do not need to learn all potentially relevant knowledge and skills as undergraduates (and there wouldn't be time anyway). Employers provide a substantial amount of investment in both formal and informal training [3]. Physicists working in technical sales may get targeted communication training. Workers in small STEM businesses may get grant writing training for Small Business Innovation Research proposals. Leadership and management training is also commonly provided. Specialized training for specific software or hardware may be taught informally or via continuing education. Businesses innovate and employees learn so it is essential that students are motivated and capable learners.

Final thoughts

> In addition to understanding overall strategies for mentoring, it is valuable to make local connections with companies and to encourage students to do the same.

For example, our institution is located in Rochester, NY, which has a high density of optics jobs. Many of these are a good fit for physics majors. Your part of the country may have different balance of employers. Knowing the various employers in your region can open doors to co-ops and assist students who desire to stay in the geographic region around their school. If there is the possibility of joining local sections of professional associations or industry groups, faculty and students can seize those opportunities for making more connections with industry. Partnering with community colleges can also be helpful as they are usually more in touch with local employers.

The private sector offers diverse and interesting career paths for physics majors. It may be uncharted territory for faculty who have been on an all-academic trajectory since high school, but learning about these issues is a terrific way to support our students as they leave college and begin their careers. Anyone interested in learning more should read Phys21: Preparing Physics Students for 21st Century Careers, which was recently released by APS and the American Association of Physics Teachers [4]. ■

References

1. Society for Physics Students Careers Toolbox https://www.spsnational.org/careerstoolbox
2. American Association of Colleges and Universities, Falling Short? College Learning and Career Success https://www.aacu.org/leap/public-opinion-research/2015-survey-falling-short
3. Carnavale, Strohl, Gulish, College Is Just the Beginning: Employer's Role in the $1.1 Trillion Postsecondary Education and Training System, Georgetown Center on Education and the Workforce (2015) https://cew.georgetown.edu/cew-reports/college-is-just-the-beginning
4. Phys21: Preparing Physics Students for 21st Century Careers, A report by the Joint Task Force on Undergraduate Physics Programs, Paula Heron and Laurie McNeil, Co-chairs (2016) http://www.compadre.org/jtupp/report.cfm.

The 2016 National Mentoring Community Conference Highlights

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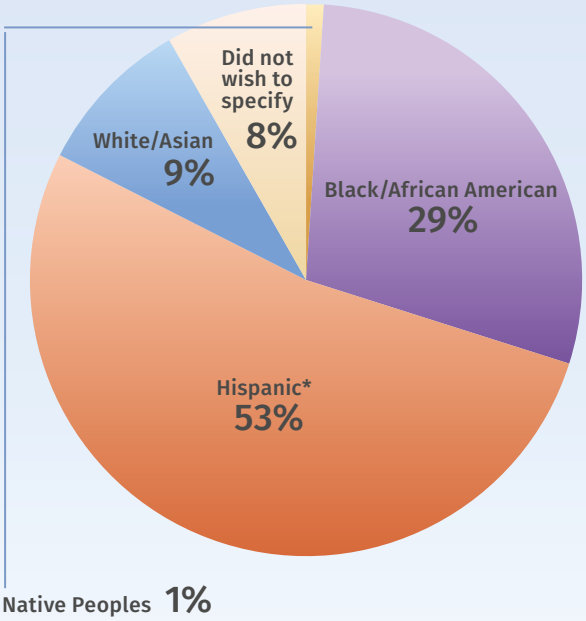
conference survey results, the NMC Conference at the University of Houston was a big success! The majority of the conference survey respondents (70%) found the sessions useful or very useful, plan to attend upcoming NMC Conferences, and would encourage others to attend (98%). At APS, we hope to see all of you at the next conference! ■

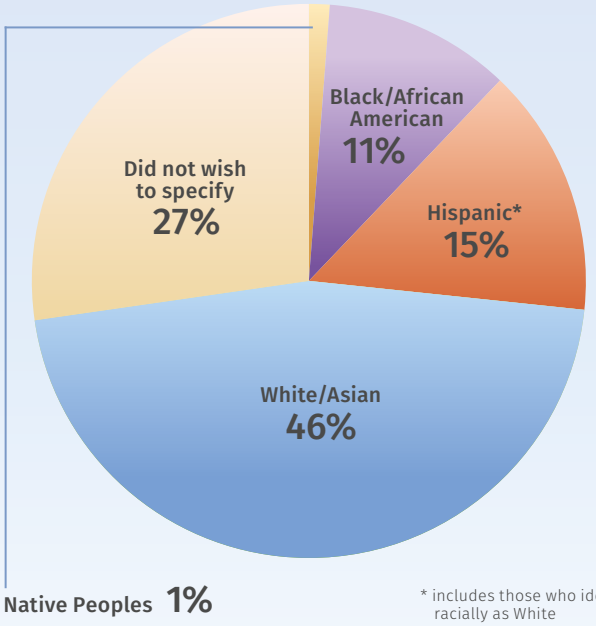
l. to r. - Ecieno Carmona (NMC Student), Eric Vickers (NMC Student), Ted Hodapp (APS), Arlene Modeste Knowles (APS), Sesha Srinivasan (NMC Mentor), Kathryne Woodle (APS), and Dieff Vital (NMC Student).

APS NATIONAL MENTORING COMMUNITY AT-A-GLANCE

2016 NMC Mentee Race/Ethnicity Distribution



2016 NMC Mentor Race/Ethnicity Distribution



* includes those who identified racially as White

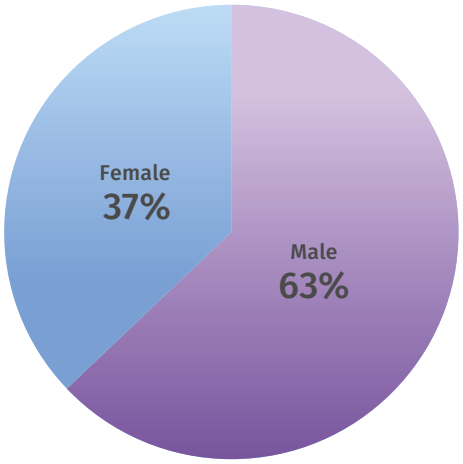
97 REGISTERED MENTEES

165 NMC MENTORS

48% of NMC mentoring relationships are comprised of Minority Mentees with Non-Minority Mentors

116 Universities have NMC faculty mentors

2016 NMC Mentee Gender Distribution



Can you mentor one URM student?

The goal of the **APS National Mentoring Community (NMC)** is to significantly increase the number of underrepresented racial and ethnic minority (URM) students earning physics bachelor's degrees by identifying and supporting a community of mentors who will provide guidance to these undergraduate students.

To learn more about the program and to register as a mentor or mentee, please visit **www.aps.org/nmc**.

Conversations

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