

HARNESSING THE POWER OF BLACK EXCELLENCE IN PHYSICS AND ASTRONOMY

A REPORT FROM THE AFRICAN AMERICAN WORKFORCE DEVELOPMENT IN PHYSICS AND ASTRONOMY WORKSHOP

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University of Southern California
Center for Education, Identity and Social Justice

University of Southern California
Pullias Center for Higher Education

National Society of Black Physicists

National Science Foundation



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BACKGROUND



Over the past decade, there has been considerable effort focused on the reinforcement of the STEM pathways in the United States. While there has been a burgeoning body of research on the experiences of students of color and African American students in STEM generally, there have been fewer studies conducted on the specific experiences of African Americans pursuing degrees and careers in physics and astronomy. Researchers have found that faculty members play a significant role in the positive and negative experiences of students of color in the physical sciences and STEM fields (Fries-Britt, Younger, & Hall, 2011). Scholars have found faculty-student interactions and mentoring to be integral toward increasing the overall levels of college satisfaction, cognitive development, and persistence to graduation for students of color (Crisp & Cruz, 2009; Kuh & Hu, 2001; Pascarella & Terenzini, 2005). Hence, the role faculty-student interactions play is fundamental for exploring ways to improve the pathways for students of color interested in pursuing careers in physics and astronomy.

Data collected by the National Science Foundation and the National Center of Science and Engineering Statistics suggests that African Americans are woefully underrepresented in undergraduate and doctoral degree attainment, within faculty positions and professional private industry/governmental careers in the physical sciences. To enhance workforce development for African Americans in physics and astronomy, we collaborated with the National Society of Black Physicists (NSBP) to better understand the nature of the underrepresentation problem in physics and astronomy. More discussion is needed among critical stakeholders to understand the experiences and decision-making processes about professional pathways. The purpose of this project is to convene a group of stakeholders/experts in PK-12, higher education (from HBCUs and historically White campuses), and academic and industry careers with a range of expertise on academic and industry career pathways for African American students interested in the physical sciences.

AFRICAN AMERICANS IN PHYSICS

Race	U.S. Pop.	UG Degrees in Physical Sciences	Doctoral Degrees in Physical Sciences	All Faculty Positions in Physical Sciences	Employed as Physicist or Astronomer
Black	12.3%	6.4%	1.7%	2.3%	*
Asian	5.0%	11.5%	5.2%	15.8%	20.6%
Latino/Hispanic	17.0%	7.0%	2.9%	3.6%	5.9%
American Indian	0.9%	0.4%	0.1%	*	*
White	63.0%	63.0%	42.3%	69.2%	73.5%

Table 1 – Racial Breakdown of U.S. Population, Undergraduate Degrees, Doctoral, all Faculty Positions in Physical Science, and Employment as a Physicist/Astronomer

* = Too few to calculate or the number has been suppressed for confidentiality

Source: National Science Foundation, National Center of Science and Engineering Statistics, 2013. Women, Minorities, and Persons with Disabilities in Science and Engineering: 2013 Special Report, NSF 13-304. Arlington, VA.

PRE-CONFERENCE WORKSHOP PARTICIPANTS

Arti Agrawal PhD is Associate Professor at the University of Technology Sydney in the Faculty of Engineering and IT and the Director of Women in Engineering and IT. She is Associate Vice President for Diversity for IEEE Photonics Society.

Brian Beckford PhD is Professor of Physics at the New York City College of Technology of the City University of New York.

Reginald Blake PhD is Presidential Postdoctoral Fellow at the University of Michigan Physics department.

Tabbye Chavous PhD is Professor of Education and Psychology at the University of Michigan and Director of the university's National Center for Institutional Diversity.

Yanne Chembo PhD is a member of the International Commission of Optics (ICO) steering committee for Regional Development until September 2017, and of the IEEE Photonics Society board in charge of outreach.

Marta Dark McNeese PhD is Associate Professor at Spelman College in the Physics department.

Earnestine Psalmonds Easter PhD is Program Director in the Division of Graduate Education at the National Science Foundation (NSF).

Terry K. Flenbaugh PhD is Assistant Professor of Race, Culture, and Equity in Education and Coordinator of Urban Education Initiatives in the department of Teacher Education at Michigan State University.

Byron Freelon PhD is a member of the board of directors of the National Society of Black Physicists. He is currently a faculty member in the Physics department of the University of Louisville.

Ronald S. Gamble Jr PhD is a theoretical astrophysicist and recent graduate from North Carolina Agricultural & Technical State University.

Anita Gopal PhD is International Officer for the National Postdoctoral Association. She recently completed a postdoctoral fellowship at the University of Maryland, College Park.

Theodore Hodapp PhD is Director of Project Development and Senior Advisor to Education and Diversity for the American Physical Society in College Park, Maryland.

Caesar R. Jackson PhD is Professor of Physics at North Carolina Central University. He previously served as Dean, School of Graduate Studies and Dean, College of Arts and Sciences. He served 3 years at National Science Foundation in program director and division director roles.

Dawn Johnson PhD is Associate Professor and Chair of the Higher Education department at Syracuse University.

Lauren A. Mecum PhD is Community Outreach & Development Manager for the IEEE Photonics Society.

Brian Nord PhD is Associate Scientist at Fermilab in Batavia, Illinois and Visiting Assistant Research Professor in the Department of Astronomy and Astrophysics at the University of Chicago.

Robert T Palmer PhD is Associate Professor of Educational Leadership and Policy Studies at Howard University.

Monica Plisch PhD is Director of Education and Diversity at the American Physical Society (APS).

Sarah Rodriguez PhD is Assistant Professor of Higher Education/Community College Leadership at Iowa State University.

Milton Dean Slaughter PhD is an American theoretical and phenomenological physicist and Visiting Professor of Physics at Florida International University.

Lyndele Von Schill PhD is Director of the National Radio Astronomy Observatory (NRAO) Office of Diversity & Inclusion.

Joseph Whittaker PhD is Associate Provost at Jackson State University. He was previously Dean and Professor of the School of Computer, Mathematical and Natural Sciences at Morgan State University.

Callie C. Womble PhD is Commission Research Specialists for the North Carolina Department of Commerce.

GOALS AND GUIDING QUESTIONS AT THE PRE-CONFERENCE WORKSHOP

GOALS

- Build space for networking and ongoing face-to-face collaboration as well as online networking opportunities
- Facilitate future interactions between stakeholders and STEM resource agencies
- Identify strategies that help NSBP better achieve its mission to increase the employment of African American physicists and astronomers in the STEM workforce
- Develop an action plan for the career trajectory of African American physicists and astronomers

GUIDING QUESTIONS

- What are the defining issues/concerns?
- What gatekeeping barriers exist for African Americans?
- How do we increase the number of African American physicists and astronomers in the field?
- How do we retain African American physicists and astronomers in the field?
- Why is this important beyond the community it will serve?
- Who are the stakeholders?
- What are the existing research gaps in this area?

CONCEPTUAL FRAMEWORK

The pre-conference workshop employed a “strengths-based, pathway model.” This approach requires a process of identifying sites of excellence and exploring strategies to build on their strengths. The method seeks to understand

- What works well?
- How does it work?
- Can it be scaled or replicated?

In fact, this is a ‘scale up’ or, more accurately, a ‘scale out’ from a similar workshop conducted in June 2016 for African American engineers led by Dr. John Slaughter (former NSF Director), Co-PI on this project.

The know-how available to us and the knowledge gained through the workshop may facilitate interventions that create a more coordinated sequence of positive experiences that provide critical developmental support and opportunities to enhance the strengths and capabilities of African Americans.

We argue that the knowledge gained from the programs, policies, and practices at educational and employing institutions of excellence will lead to more successful interventions for African Americans at each critical transition point from education to the physics and astronomy workforce. The proposed “strengths-based, pathway” approach provides a more action-oriented, systematic, data-driven strategy to broaden the participation of African Americans in the physics and astronomy workforce.

BREAKOUT SESSION

Participants representing four-year institutions, professional organizations, government organizations and research organizations convened over the course of two days to discuss and develop an action plan for the career trajectory of African Americans in physics and astronomy fields. Participants were placed in breakout groups to address questions of how to increase access and retain African Americans.

DAY 1: THURSDAY, NOVEMBER 2ND AT MOREHOUSE COLLEGE

BREAKOUT SESSION #1: CHALLENGES AND BARRIERS TO SUCCESS

- What are challenges African American students face when entering the fields of physics and astronomy?
- What are some of the gate keeping barriers that African Americans face when attempting to enter the workforce and future opportunities?
- Once in the field, what are challenges African American students encounter?
- What more do we need to know to be proactive in addressing the challenges they face?

DAY 2: FRIDAY, NOVEMBER 3RD AT THE HILTON ATLANTA CONFERENCE HOTEL

BREAKOUT SESSION #2: SUCCESSFUL INTERVENTIONS/ STRATEGIES TO PROMOTE WORKFORCE DEVELOPMENT

Taking into consideration conversation around challenges and barriers on Day 1:

- What strategies and systems do we have in place that effectively recruit, retain, and provide opportunities for African Americans in physics and astronomy regarding workforce development (e.g., faculty positions, government agencies, private industry, national laboratories)?
- What are the gaps in these current strategies and systems?

THE FOLLOWING FOUR THEMES EMERGED FROM THE BREAKOUT SESSIONS:

1. Pedagogy and Curriculum
2. Workforce Development
3. Ideas for Improving Access
4. Solutions and Partnerships

1. PEDAGOGY AND CURRICULUM

Issue

Participants discussed how the low representation of African Americans in the physics fields starts in K-12 education and carries forward into college. In K-12 education, students are often taught by teachers who do not have the certification or sufficient knowledge to inform or inspire them to pursue physics or astronomy careers. Some students do not have access to advanced levels of science or mathematics at their high schools and leave K-12 schools underprepared for the rigors of college-level courses. By the time students arrive at college, students feel underprepared overall and may not know about the many opportunities available in the fields of physics and astronomy. Moreover, first-generation college students and some African Americans experience added pressure to catch up to peers who had prior exposure and preparation for the rigors of physics and astronomy.

Solution

To address such issues, participants suggested working to improve the pathway by exposing children to the field of physics at a young age. Participants indicated that individuals working in the area of physics must collaborate more closely with professionals across the educational landscape, with particular attention to the training and preparation of teachers in science and physics. Also, participants strongly advocated for having physicists and astronomers as guests in classrooms to expose students to the variety of career pathways within the physics and astronomy fields.

To address the realities of some lower-income communities, participants suggested working with physics labs and professional associations to bring physics after-school programs or summer camps to young students. The staff for such programs could consist of both professionals and undergraduate students in the field of physics and astronomy with a clear and specific objective to provide school-aged children with enriching and hands-on physics and astronomy related activities. While there is a substantive value of increased early exposure to physics and astronomy, the direct benefits for undergraduate physics and astronomy majors is likely most evident through the mentorship, networking, and workforce development opportunities established through such enriching after-school programs. These kinds of interactions and relationships will likely contribute towards students in undergraduate physics and astronomy majors acquiring significant professional development, which can provide positive and direct workforce development outcomes.

2. WORKFORCE DEVELOPMENT

Issue

Drawing from years of collective experience, participants discussed the challenges of transitioning from college to work, often because the process of entering the workforce can be unclear. It is often perceived that a graduate degree is necessary to enter the field and there is often insufficient information about what career options are available at various levels of education. Also, the hiring process can be confusing and, in some instances, secretive as some job postings are only shared within closed networks of which African Americans are not included. Moreover, once African Americans are on the job, they may feel isolated because they are one of few or the only African American in the organization.

Solution

To address issues of access, participants recommended stronger partnerships between labs, graduate programs, and professional associations with a specific emphasis on increasing African Americans in the field. These partnerships should focus not just on helping African Americans enter the field, but also to support them as they may feel professionally isolated in their workplace. Workplaces should have a person or department committed to diversity and inclusion. This person or department could play a role in job postings, hires, and diversity training for the lab and other similarly situated workspaces where African Americans are likely to be the only one.

Higher education institutions, professional associations, labs and other workforce partners need to make it clear that there are opportunities within the physics fields for varying education levels. Institutions agents, like faculty members and academic program officers, should expose students to different opportunities instead of promoting academia as the best or only route for physicists. Moreover, labs and other workforce partners also have a responsibility to expose students to the diverse career opportunities for physicists, which can readily be accomplished through internships and direct outreach efforts targeting networks rich with African American students.

3. IDEAS FOR IMPROVING ACCESS

Issue

For African Americans in physics and astronomy, feelings of isolation and inadequacy were identified at all levels of the pathway (i.e., early education experiences through the workforce). Throughout the educational pipeline, there are few mentors (both African American or members of other racial groups), fewer role models, and unclear or unidentified allies. In such rigorous academic and professional environments starved of mentors and role models, it is difficult for African Americans to access networks that will help them persist and succeed in physics and astronomy. At each level, the issue of access is at best overlooked and, at worst, undermined because there is a greater focus on science rather than the scientist; and more importantly, what scientist mean to the communities they serve and from which they hail.

Solution

Throughout all academic and professional levels, participants suggested increasing mentorship. Mentors are needed from educational settings, labs and other possible career-related workplaces. Students and professionals both need mentors to succeed, while also diminishing feelings of isolation and alienation in physics and astronomy. Setting up formal mentorship processes can be helpful. Also, African Americans mentoring African Americans can have added value because they also serve as role models, but greater commitment and allyship from other communities at all levels is also needed. Identifying such allies should make it easier for African Americans to know who they can turn to for support.

Developing robust and meaningful networking opportunities where African Americans feel welcomed, supported, and safe offer yet another chance to increase access in the educational pathway and the workforce. Many networking opportunities, which are well-intentioned, often fall short when there is no clear commitment to assist African Americans to achieve specific goals or accomplish meaningful professional objectives. African Americans need particular support in developing networking skills (e.g., attire, discipline specific etiquette, resume/CV building). When appropriate, it may even be helpful to bring in professionals from other fields to facilitate processes of mentorship, allyship, and networking all aimed at increasing the number of African Americans in the field.

4. SOLUTIONS AND PARTNERSHIPS

Issue

Participants discussed how different fields and even different sectors within physics are siloed. For example, in the group, some participants worked in the field of physics education, and others in physics labs and research-specific positions. Although both professional groups had a desire to improve conditions for African Americans in physics and astronomy, they recognized that they do not often talk to each other, share resources, or best practices. Some participants felt the lack of collaboration has led many to tackle the same issues in isolation, which forgo opportunities to combine resources and leverage meaningful knowledge constructs that have the potential to strengthen and sustain a significant and productive experience for African Americans in the field of physics and astronomy.

Solution

Participants recognized that creating spaces to talk with experts in other fields was beneficial to start the process of building a partnership that would help address the issues that African Americans are facing in the field of physics and astronomy. They recognized that different areas and different sectors have diverse expertise and resources that when integrated could create meaningful change.

To create meaningful change across the board, participants suggested forming more opportunities to collaborate and share ideas. Additionally, they suggested adding positions within physics labs and professional associations that are not strictly focused on physics research, but instead are purposefully aimed to address access, diversity, and inclusivity of African Americans. Another potential solution is to increase partnerships from early education through the workforce to expose students early, help teachers impact the curriculum, and create solutions across different educational levels.

INVITED TALK: AMERICAN PHYSICAL SOCIETY (APS) BRIDGE PROGRAM

The Bridge Program is an initiative of the APS Education and Diversity Program that aims to support students applying to physics and astronomy graduate programs for the second time. Standardized exam scores are a major gate keeping barrier for these students, particularly African Americans, as many graduate schools use a cutoff score for admissions. Theodore Hodapp PhD, Director of Project Development for APS Education and Diversity Programs, advocates for admission reform toward a holistic review of applications that focus on growth mindset instead of fixed mindset, which traditionally exclude certain student populations.



THEODORE HODAPP PHD

INVITED TALK: AMERICAN PHYSICAL SOCIETY (APS) EDUCATION & DIVERSITY PROGRAMS

APS Education and Diversity Programs is designed to support student success and retention in the field of physics and astronomy through initiatives such as the National Mentoring Community (NMC), a faculty mentorship program, and emergency aid funds. Monica Plisch PhD, Director of Education and Diversity at APS, highlighted the importance of these program in increasing student confidence, knowledge, opportunities and intent in completing their bachelor's degree.



MONICA PILSCH PHD

INVITED TALK: PERSPECTIVE FROM THE NATIONAL SCIENCE FOUNDATION (NSF)

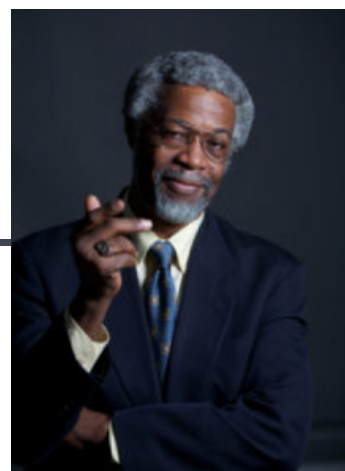
NSF seeks to support interdisciplinary research and publications for meaningful contributions to society. Earnestine Psalmonds Easter PhD, Program Director in the Division of Graduate Education at the National Science Foundation, encouraged interdisciplinary partnerships at NSBP to foster advancement and inclusion of African Americans in the physics and astronomy field.



**EARNESTINE PSALMONDS
EASTER PHD**

OPENING PLENARY KEYNOTE: A VIEW OF OBAMA'S ADMINISTRATION POLICY FOR THE AMERICAN DREAM, THE WORK FORCE & THE 2009-2017 PCAST REPORTS

The challenges of the globalized world require a community of change-makers from the STEM field. Sylvester James "Jim" Gates Jr PhD, American theoretical physicist and former John S. Toll Professor of University of Maryland Regents System, emphasized the critical role of African American representation in the STEM field as agents of change in creating positive solutions for the global issues of the modern era.



**SYLVESTER JAMES "JIM"
GATES JR PHD**



Pictured left to right: Carl Fields - Doctoral Student at University of Michigan, Marquin Spann - Undergraduate Sophomore at North Carolina A&T State University, Grey Batie - Doctoral Student at University of California, Berkeley, Bria Storr - Undergraduate Senior at Fisk University, Shaun Hampton - Doctoral Student at Ohio State University

Guiding Questions

- What are some challenges you've faced as a student in physics/astronomy?
- Where or with whom have you found support in your educational journey?
- What recommendations would you give to schools and faculty?
- What steps have you taken to prepare for the job application process/workforce?
- What support in the workforce would help you succeed?

Students shared their experiences in both undergraduate and graduate programs. A common theme among the student experience is that they have faced are microaggressions and feeling like they do not belong in their academic spaces (i.e., imposter syndrome and 'chilly academic environments'). To meet these challenges, students have turned to their peer cohorts and advisors for support while in school. Outside of educational settings, students have turned to religious communities and their family for support. Students relied a lot on mentors and wanted to have more frequent mentor-mentee interactions. The student panelists were motivated to succeed and already serve as role models and mentors for other students earlier along the educational pathway in physics and astronomy.

Participants recommended that professors and employers must provide more support to help students and early-career professionals succeed. The panelists stressed the importance of making this support more widely-known by promoting and communicating the allyship for the Black community in physics and astronomy academic and career trajectories. The student panelists also recommended more representation of different social identities and the intersection of those social identities (i.e., Black and woman or Black and LGBTQ) at all levels. A broad array of African American students who occupy different social identities need to understand that academia is but one of many routes to success in the field.

BREAKOUT SESSION #3: CREATIVE SOLUTIONS & OPPORTUNITIES FOR CROSS-COLLABORATIONS & FUTURE RESEARCH

Each breakout group created a comprehensive initiative that would address major challenges in workforce development for African Americans in physics and astronomy. Initiatives addressed the following questions:

- Which individuals and organizations are critical stakeholders and important partners in creating opportunities for African Americans in physics and astronomy?
- If funding was not an issue, what resources, positional power, and organizations would you leverage in order to create solutions and opportunities for African Americans in physics and astronomy?

BIG IDEAS

Each group presented their ideas to the rest of the participants. All participants were asked to sign their name or their organization's name next to the initiatives that they thought they could commit to in order to begin building real partnerships outside of the convening.

Initiatives	Potential Partners
Mobile physics camps for students that can move through different communities	Institute of Electrical and Electronics Engineers (IEEE), and Brian Nord PhD (Fermilab)
Youth competitions	IEEE
Increase mentorship across all levels for the physics field (starting in K-12 education all the way through the workforce)	IEEE, Terry Flennaugh PhD, and Brian Nord PhD (Fermilab)
Change curriculum/teacher training to help students better understand the field of physics	IEEE, Terry Flennaugh PhD, Brian Nord PhD (Fermilab), Reginald Blake PhD, Robert Palmer PhD, Sarah Rodriguez PhD, and Yanne Chembo PhD
Themed week at schools about physics professions	Martha Dark McNeese PhD, Ron Gamble PhD, Ceasar Jackson PhD, Dawn Johnson PhD, Joseph Whittaker PhD, Lauren Meeum PhD, and Tabby Chavous PhD
What does it mean to be a Black physicist?	Callie Womble PhD, Brian Beckford PhD, Brian Nord PhD (Fermilab)



Mobile physics camps for students that can move through different communities

Given the shortage of resources in many urban schools for which a considerable portion of African American students find themselves enrolled, participants felt that Physics labs should be brought to them. Physics labs and equipment are very expensive, and it would be more efficient to have a mobile lab come to students. The initial ideas were to have a pair of undergraduate physics or astronomy majors travel to partner middle schools to engage in a school-based or after school program.

Youth competitions

Battle bots, LEGO® leagues, and computer hack-a-thons were the inspiration behind this idea. Participants believe that these youth competitions have propelled interest in the engineering and computer science fields. Could we leverage this concept with an equivalent youth competition geared towards physics and astronomy? This project requires the utilization of our networks for collaboration.

Increase mentorship across all levels for the physics field

Participants described a dire need for the expansion of social networks for African Americans exploring the Physics and Astronomy workforce. How can we create structured mentor programs that authentically provide the types of emotional support, professional development, strategizing, and professional networking?

Improve teacher training to help students better understand the field of physics

Participants described the many challenges of under-qualified teachers in science (and physics in particular) in middle school and high school. Universities and school districts need to create better partnerships to continue to provide the appropriate pre-service and in-service training.

Themed week at schools about physics professions

The student panel was partially the impetus for this idea as student panelists described not having clear understandings of what a profession in physics was beyond being a university faculty member or a high school physics teacher. A greater understanding of various professional pathways is needed. The cliché of hosting medical doctors, lawyers, police officers, and firefighters for school career days is common and problematic. It is extremely important for students to learn about becoming a scientist and demystifying who physicists are early in their education to develop a diverse workforce in physics and astronomy.

What does it mean to be a Black physicist?

Drawing inspiration from the student panel, this project focuses on the many intersecting social identities that seem to conflict with being a physicist or astronomer. This idea is geared towards rewriting the narrative around what it means to be a physicist by capturing stories of Black physicists from a modern perspective.

EVALUATOR



LETICIA OSEGUERA PHD

Leticia Oseguera PhD is Associate Professor and Research Associate in the Department of Education Policy Studies and the Center for the Study of Higher Education at the Pennsylvania State University. She received her master's and doctoral degree from the Higher Education and Organizational Change Program at UCLA. Prior to Penn State, Dr. Oseguera was Assistant Professor in the Department of Education at the University of California, Irvine. Her research focuses on understanding access and educational opportunities for historically underserved and underrepresented student populations.

Dr. Oseguera served as the external evaluator for the two-day workshop. She received the workshop goals and materials prior to the convening. As evaluator, Dr. Oseguera participated in different breakout groups to capture participants' perspectives and ideas. At the end of the two-day convening, she administered a short paper survey to participants. 22 participants attended the second day of the convening and 17 of those returned a completed survey. The evaluations are based on her notes throughout the convening as well as the survey administered to participants.

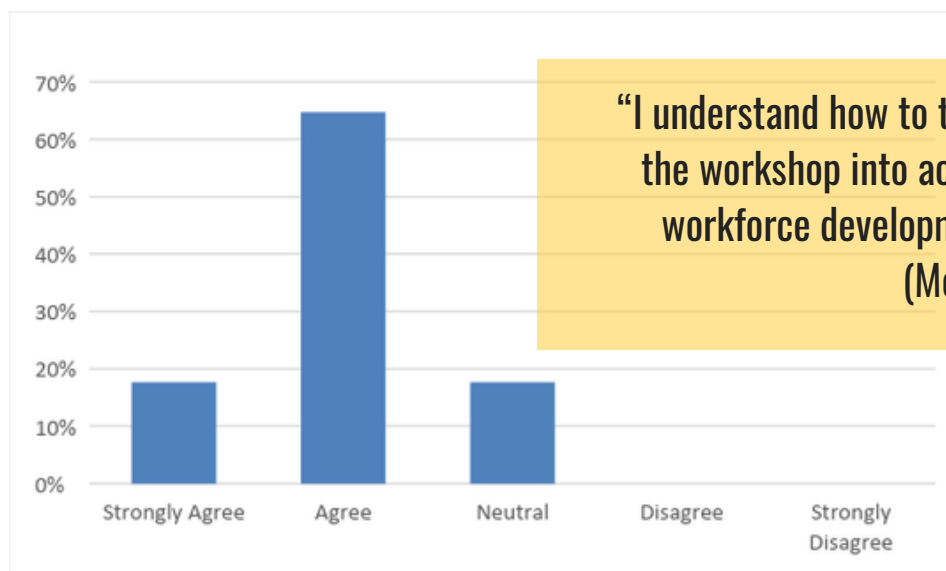
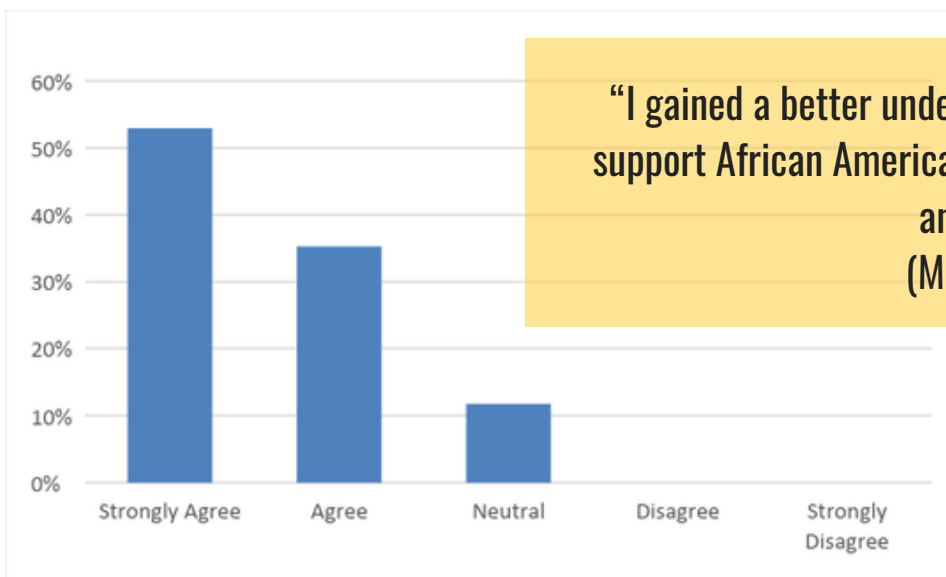
SUMMARY OF EVALUATION

Dr. Oseguera believed the NSBP Pre-Conference convening was well-organized and met each of the core objectives. One overarching observation was that throughout the first night of the NSBP Pre-Conference, participant conversations were more siloed within the scope of their work experience, but by the second day, they moved more towards collaborations across different sectors (i.e., education scholars, physicists, and leaders within national organizations). The participant evaluations also indicated that by the end of the convening, participants were better able to understand the importance of establishing critical partnerships and meaningful cooperation toward increasing the number of African Americans in physics and astronomy.

SUMMARY OF EVALUATION

Another critical observation was that there was some uncertainty as to what “workforce preparation” meant or what it signaled to participants throughout the workshop. Dr. Oseguera noted that although the conveners encouraged participants to discuss workforce on a continuum of career opportunity and success, there was limited discussion of workforce preparation for those who did not pursue a PhD. There was an overemphasis on pursuing PhDs and that there was no point in pursuing a degree in Physics or Astronomy if a PhD or obtaining an academic career were not in the plan. Many participants could not seem to fully articulate meaningful career opportunities for students with an AS or BS in Physics. A small fraction of participants, however, admitted that this was an awkward and difficult conversation for the field and that they, as a professional field, need to find ways to better articulate the utility and value of an AS or BS to diverse professional workforce goals.

Dr. Oseguera believed that the overall intended goals were achieved. The following snippet of the survey results support Dr. Oseguera’s final assessment and conclusions.



CONCLUSION AND RECOMMENDATIONS

The purpose of this NSBP Pre-Conference was to convene a group of stakeholders and experts in PK-12, higher education (from HBCUs and historically White campuses), and academic and industry careers with a range of expertise on academic and industry career pathways for African American students interested in the physical sciences. Conceptually, the workshop employed a “strengths-based, pathway model,” which requires a process of identifying sites of excellence and exploring strategies to build on their strengths. As noted earlier, this first pre-conference event is a ‘scale up’ or, more aptly put, a ‘scale out’ from similar work conducted for African American engineers led by Dr. John Slaughter (former NSF Director), Co-PI on this project.

We were able to discern four themes that emerged from this pre-conference event: pedagogy and curriculum, workforce development, ideas for improving access, and solutions and partnerships. For each theme, we were able to identify at least one important recommendation for those interested in creating substantive efforts to increase the number of African Americans in physics and astronomy.

Pedagogy and curriculum

There is a need to bolster culturally relevant pedagogy and knowledge of diverse learners in this field as it was commonly assumed and asserted that only the “best and brightest” are well-suited for physics and astronomy fields. The “best and brightest” often revolved around the idea of high grades and test scores as requirements to enter and persist in the field of physics. Participants regularly communicated that there was a linear and almost singular, trajectory to joining the professional ranks of the field. Such perspectives and resulting academic and professional practices need examining as multiple participants spoke of the varied routes they took to achieve success; yet, the emphasis in discussions and 'sidebar' conversations still revolved around high grades and test scores. Stated plainly, participants noted a prevailing notion within the field that many ascribe to a fixed mindset of intellectual ability. In that, students are either smart enough or not for the rigors of physics. Therefore, students who have above average but not excellent grades and test scores indicated that a student was not smart enough for physics and should consider another field of study.

Additionally, some students do not have access to advanced levels of science or mathematics at their high schools and leave K-12 schools underprepared for the rigors of college-level courses. To address such issues, we recommend programs designed to improve the educational and workforce pathway by exposing children to the field of physics at a young age. Participants also advocated for having physicists and astronomers as guests in classrooms to enhance student exposure to the variety of physics and astronomy career pathways.

Workforce development

There was a disconnect between theory and practice. The word “workforce” seemed to be misunderstood or lost through the initial conversations. The emphasis on the term “workforce” was interpreted as producing more PhDs and moving to increase the number of African American faculty in physics and astronomy. Moreover, the physics and astronomy curriculum needs to be revised to communicate better that graduate degrees are not the only pathway into physics and astronomy jobs. “Workforce,” as a comprehensive and diverse set of physics- and astronomy-related careers needs to be better articulated and defined so that efforts to support students and their subsequent professional interests are matched with BS or AS degrees in physics and astronomy.

Improving access

We recommended stronger partnerships between labs, graduate programs, and professional associations with a specific emphasis not just on helping African Americans enter the field, but also to support them in their workplace and the scaffolding needed for their long-term professional success. Professional workspaces should also have personnel or departments tasked with and committed to diversity and inclusion, and share responsibility beyond their role in job postings, hires, and diversity training to establishing mentorship opportunities toward long-term professional success.

Solutions and partnerships

Participants discussed at length how the differences within and even across sectors in physics are siloed. We recommend that more opportunities like NSBP professional and student convenings be created for African Americans students and professionals in physics and astronomy to talk to each other, share resources, and best academic and professional practices.

In conclusion, continued work is needed to bring similar groups of professionals and scholars together toward increasing the representation of African Americans in physics and astronomy. More concerted effort beyond access to include diversity and address issues of inclusivity are needed.

COLLABORATORS FROM THE NATIONAL SOCIETY OF BLACK PHYSICISTS



**BYRON
FREELON PHD**

Byron Freelon PhD is Assistant Professor of Physics and Astronomy at the University of Louisville. He received a bachelor's of science in physics from Prairie View A&M University in Texas. He received a PhD in physics, with a specialty in experimental condensed matter physics, from the University of Minnesota in 2001.

Dr. Freelon worked as a postdoc at the Advanced Light Source (ALS) at the Lawrence Berkeley National Laboratory. Subsequently, he served as a staff scientist at the University of California Berkeley in the group of UC Berkeley Chancellor Robert Birgeneau. Freelon held the position of staff scientist at the Argonne National Laboratory working in the Advanced Photon Source (APS) Division. He is interested in various x-ray and neutron scattering techniques to study high-temperature superconductors, soft-matter systems and novel 2-dimensional materials.

Dr. Freelon has served as a member of the American Physical Society (APS) Committee on Careers. In addition, he participated in the Conference Committee of the National Society of Black Physicists (NSBP). He is a board member of the National Society of Black Physicists. In that capacity he was the Co-PI for grants awarded by the NSF.



**K RENEE
HORTON PHD**

K Renee Horton PhD is a graduate of Louisiana State University with a BS of Electrical Engineering with a minor in Math in 2002 and a PhD in Material Science with a concentration in Physics, becoming the first African American to graduate from the University of Alabama in 2011 in this area.

Dr. Horton currently serves as the Space Launch System (SLS) Lead Metallic/Weld Engineer in the NASA Residential Management Office at Michoud Assembly Facility (MAF) in New Orleans. She worked for NASA, first as a student from 2009 to 2011, and then started her career as a mechanical test engineer in 2012. In 2014, she was promoted to her current position.

In 2016, Dr. Horton was elected President of the National Society of Black Physicists (NSBP) as the second woman to hold the office. She has served the physics community abroad as a member of the International Union of Pure and Applied Physics (IUPAP) Women in Physics Working Group and currently serves on several advisory boards dedicated to a more diverse inclusion in physics. In 2017, she was elevated to a Fellow in the NSBP, which is the highest honor bestowed upon a member.



SUMMER WORKSHOP

PARTICIPANTS

Byron Freelon PhD is a member of the board of directors of the National Society of Black Physicists (NSBP). He is currently a faculty member in the physics department of the University of Louisville.

Cesar Jackson PhD is a professor of physics at North Carolina Central University. He previously served as dean, School of Graduate Studies and dean, College of Arts and Sciences. He served 3 years at National Science Foundation in program director and division director roles.

Brian Nord PhD is an associate scientist at Fermilab in Batavia, Illinois and visiting assistant research professor in the department of astronomy and astrophysics at the University of Chicago.

Willie Rockward PhD is the current president of NSBP. He is the chair and professor of physics at Morgan State University.

Devin Waller MS is the exhibit project manager at the California Science Center.

GOALS FOR THE SUMMER WORKSHOP

- Increase support for NSBP and current NSBP president
- Make concrete commitments of resources and organizations to help increase African American Access in the physics and astronomy field
- Outline expected tasks for each organization and partner
- Obtain letters of support from each partner organization
- Draft proposals for further funding and initiatives to help African Americans in the field of physics and astronomy
- Create curricula table for physics and astronomy to prepare students at a young age

REVIEW OF HARNESSING THE POWER OF BLACK EXCELLENCE IN PHYSICS AND ASTRONOMY

Some of the summer workshop participants attended the NSBP Pre-Conference (pre-conference) in November 2017. All participants received a copy of the pre-conference report prior to the summer workshop. Participants addressed the issue that prior to the pre-conference, conversations and efforts were siloed, and were therefore unable to help African Americans in the field in the best way possible.

Participants in the summer workshop held discussions regarding the four themes (1. pedagogy and curriculum, 2. workforce development, 3. ideas for improving access, and 4. solutions and partnerships) and generally agreed that these were important areas to address in order to advance opportunity and access in the field of physics for Black students and professionals.

During the pre-conference in November 2017, participants offered several big ideas to address key questions to strengthen the pipeline for Black physicists. All of the ideas centered around exposing Black children to the field of physics and addressing what it means to be a Black physicist. Summer workshop participants were excited to hear about the ideas that were offered at the pre-conference. They discussed different strategies and shared potential partnerships in order to actualize some of these ideas to begin strengthening the pipeline and offering greater opportunities for Black physicists.

ACTUALIZING THE BIG IDEAS

Summer workshop participants moved toward combining some of the key ideas from the pre-conference to create a larger project that would address various questions and levels of the pipeline for Black physicists. The project centered around creating a mobile physics camp for middle school students that would foster youth competitions. The camps would be staffed by students from local universities and colleges. Professors and industry professionals would serve as mentors and supervisors for the college students and youth competitions. The pipeline would be strengthened by creating mentorship and opportunities at various levels, starting from middle school and extending through the workforce.

In order to move into actualizing the project, participants discussed the need to create partnerships and leverage networks. Some potential partners have different components that may be helpful for actualizing the project. For example, local science centers have curriculum that engages children that can be adapted for the purposes of the project. By bringing these projects and curriculum to the schools, partnerships can be created with teachers and other educators to influence children at a young age. By including professors and industry professionals, college students will be exposed to different career options and mentorship opportunities to help with workforce development.

Participants discussed making “the big idea a reality” by coming up with a multi-part, multi-year, and multi-location project with multiple partnerships to help increase access and retention of Black physicists in the field. Having multiple partners is helpful to the project to prevent siloed interventions that were noted at the November pre-conference. Additionally, this ensured that each partner would bring their area of expertise and therefore maximize their impact. Participants addressed that there was potential to bring some funding from each of the partners, but that there would be more funding needed from governmental agencies in order to actualize the project. Participants addressed that starting this project and solidifying these networks would help the mobile labs program remain in these communities for many years and serve as a model for other communities.



At the conclusion of the meeting, participants agreed to submit a proposal for funding in order to actualize the project. Each partner will bring their expertise and tap into their networks and resources in order to strengthen the pipeline for Black students and professionals in physics. Young students would be exposed early on and college students would be presented with greater workforce development and opportunities. The funding will cover costs of materials, equipment, and programming for the project.

RESEARCH TEAM

FACULTY



DARNELL COLE PHD

Darnell Cole PhD is Associate Professor of Education with an emphasis in higher education and education psychology at the USC Rossier School of Education. He is Co-Director of the USC Rossier Center for Education, Identity and Social Justice. His areas of research include race, ethnicity, diversity, college student experiences, and learning. Previously he served as an Associate Professor in the Department of Educational Administration at the University of Hawaii, Manoa (Honolulu). He was also a faculty member at Marquette University. He has published over 40 articles and book chapters and is featured in the major journals for higher education and other related fields including *The Journal of Higher Education*, *Journal of Women and Minorities in Science and Engineering*, *Journal of College Student Development*, *NASPA Journal*, *Journal of Classroom Behavior*, and *Journal of Creative Behavior*. His most recent article "Constructive Criticism: The Role of Faculty Feedback on African American and Hispanic Students' Educational Gains" appears in the *Journal of College Student Development*.

Dr. Cole earned his bachelor's degree in Business Administration and Finance at the University of North Carolina, at Charlotte, his master's and PhD degrees in Higher Education Administration and Educational Psychology at Indiana University, Bloomington.



**JOHN BROOKS
SLAUGHTER PHD**

John Brooks Slaughter PhD is Professor of Education at USC, with a joint appointment at the Viterbi School of Engineering and the Rossier School of Education. Slaughter has had a remarkably distinguished career, which began as an electrical engineer and includes leading two universities and heading the National Science Foundation as its first African American director, among many other accomplishments. His education research has been in the areas of higher education leadership, diversity and inclusion in higher education, underrepresented minorities in STEM, and access and affordability.

In 1956, Dr. Slaughter began his career as an engineer at General Dynamics Convair, which he left in 1960 to work as a civilian at the United States Naval Electronics Laboratory Center in San Diego. He worked for the Navy for 15 years, becoming director of the Information Systems Technology Department. Slaughter went on to become Director of the Applied Physics Laboratory, a research and development facility at the University of Washington in Seattle, until his appointment as Assistant Director of the Astronomical, Atmospheric, Earth and Ocean Sciences directorate of the NSF in Washington, D.C. in 1977. In 1979, Slaughter became academic vice president and provost of Washington State University, but left for his historic appointment in 1980 as the first African American to direct the National Science Foundation. He returned to higher education in 1982 as Chancellor of the University of Maryland, where he made major advancements in the recruitment and retention of African American students and faculty. Slaughter took the job of President of Occidental College in 1988, and transformed the school during his 11-year tenure into the most diverse liberal arts college in America. He taught courses in diversity and leadership for one year as Irving R. Melbo Professor of Leadership Education at USC before accepting the position of president and CEO of the National Action Council for Minorities in Engineering (NACME), whose mission is to increase the number of engineers of color, in 2000. He is a Member of the National Academy of Engineering (NAE) and the Hall of Fame of the American Society for Engineering Education. He is a Fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, the Institute of Electrical and Electronic Engineers, and the Tau Beta Pi Honorary Engineering Society. He is the founding editor of the international journal, *Computers & Electrical Engineering*.

Dr. Slaughter holds honorary degrees from more than 25 institutions, and has received numerous awards, including the Martin Luther King, Jr. National Award in 1997; UCLA Medal of Excellence in 1989; the first U.S. Black Engineer of the Year award in 1987; the NAE Arthur M. Bueche Award in 2004; UCLA Distinguished Alumnus of the Year in 1978; NSF Distinguished Service Award in 1979, among many others.

Dr. Slaughter earned his bachelor's degree in Computer Sciences at Kansas State University, his master's in engineering from UCLA, and his PhD in engineering science from the University of California, San Diego.

RESEARCH TEAM

FACULTY



**CHRISTOPHER B
NEWMAN PHD**

Christopher B. Newman PhD is Associate Professor at Azusa Pacific University in the School of Behavioral and Applied Sciences' Department of Higher Education. His research focuses primarily on outcomes, inequities, and undergraduate student experiences in Science, Technology, Engineering and Mathematics (STEM). He also studies college readiness and pathways into postsecondary education for students of color.

Dr. Newman has served as a consultant to the National Science Foundation's Colloquy on Minority Males and has presented his work at the American Association for the Advancement of Science (AAAS), American Educational Research Association (AERA), Association for the Study of Higher (ASHE), Understanding Interventions, National Society for Black Physicists (NSBP), and United Arab Emirates University Innovation and Research for Education Excellence conferences. He is co-editor (with Shaun R. Harper) of the volume, *Students of Color in STEM*. His research has appeared in the *Journal of Women and Minorities in Science and Engineering*, *Journal of Research in Science Teaching*, *Teachers College Record*, the *Journal of Social Issues*, *The Journal of Negro Education*, and *Urban Education* among others.

Dr. Newman earned his bachelor's degree in Sociology from the University of California at Santa Barbara, his master's degree in Leadership Studies from the University of San Diego, and his master's and PhD in Higher Education and Organization Change from UCLA.

GRADUATE STUDENT RESEARCHERS



LIANE HYPOLITE

Liane Hypolite is a PhD student at USC's Rossier School of Education studying Urban Education Policy with a focus in Higher Education, conducting research with Dr. Darnell Cole. Her research interests include college supports that improve the persistence and graduation of first-generation, low-income, students of color. Before attending USC, she served as the Dean of College and Career Advising at Codman Academy Charter Public School in Boston, MA and has also worked at the national college access and success non-profit, Bottom Line, helping students to and through college. She earned her bachelor's degree at Brandeis University, double majoring in Psychology and Sociology, and earned her master's degree in Education Policy and Management at the Harvard Graduate School of Education.



TANISHA-JEAN MARTIN

Tanisha-Jean Martin is a master's student in Leadership Studies at the University of San Diego and is President of the Black Graduate Student Association. She served as a Graduate Assistant for Dr. Christopher Newman. She earned her bachelor's from San Diego State University, triple majoring in Geography, Sociology, and Political Science.



MABEL SANCHEZ

Mabel Sanchez is a PhD student at USC's Rossier School of Education studying Urban Education Policy with a focus in Higher Education, conducting research with Dr. Darnell Cole. Her research interests include students' educational gains, issues related to religion and diversity, and student's intersectional identities such as race, religion, and gender. She earned her bachelor's degree in Sociology from UCLA and earned her master's degree in Postsecondary Administration and Student Affairs at USC.

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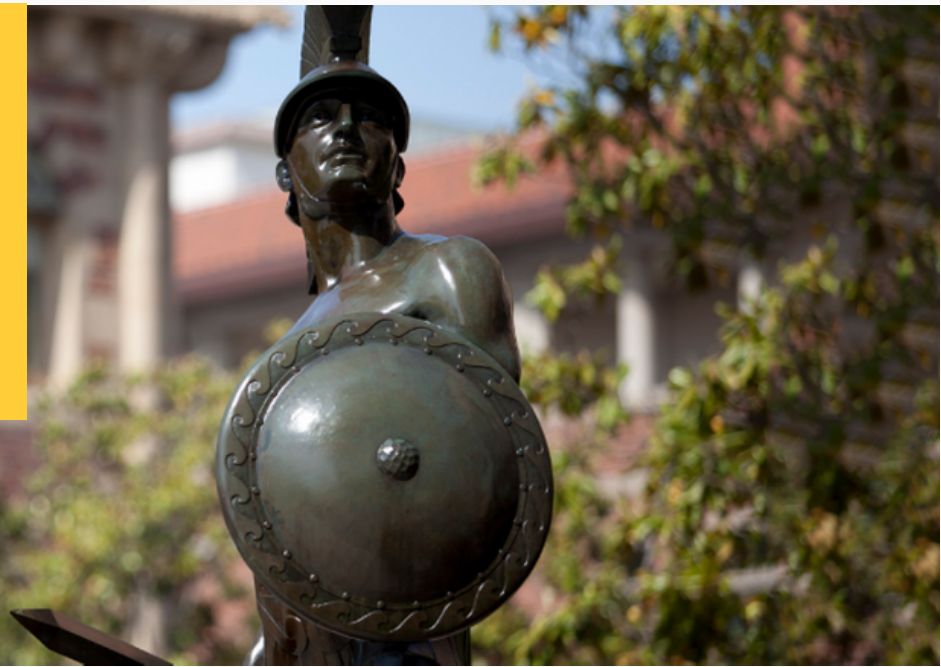
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