

Recommendations:

A Summary of the Discussions from the 2011 SPIN-UP Workshop for Physics Faculty at Historically Black Colleges and Universities “Human Capital Development in Physics” May 13-15, 2011, Hampton, VA

For Physics Departments

1. **Work on building community in the department**
 - a. Build an active Society of Physics Students (particularly important for physicists in multidisciplinary departments since it will provide a showcase for physics whether or not students are majors.)
 - b. Find a space where physics students can meet to work on problems, particularly in upper division courses. The room or part of a room will need a board on which the students can do problems collaboratively. An old couch or a used microwave is a plus but it is not necessary.
 - c. Keep an open door policy. If possible, brown bag lunches or pizza lunches attended by both faculty members and students keep lines of communication open and help the department respond to student needs.
 - d. Focus on advising and mentoring for courses but also for careers and graduate school.
 - e. Be sure that new freshmen are welcomed into the department as soon as they arrive on campus.
 - f. Work on active recruiting by building connections both to high school teachers and to the admissions staff at the university. Be sure to consider effective use of faculty and student time in recruiting (e.g. visiting individual classes vs. holding a physics day on campus).
2. **Publicize achievements in physics:** Send the Dean or the President copies of published faculty papers and reports on conferences attended by the faculty. Junior faculty should be encouraged to send material directly since their reputation is important in promotion, tenure and contract renewal discussions. Don't forget to send reports on teaching innovations along with photos of happy students. Remember that presidents and deans have to brag about the achievements of their faculty and students to donors, alumni and the press so provide them with some help that will promote physics.
3. **Build an active colloquium series:** Build a speaker series by sharing with neighboring institutions, recruiting from local industry, or taking advantage of large physics departments willing to send faculty speakers to recruit. Try to make these colloquia open to the local community at least twice a year. If possible, arrange for a large public lecture on a glitzy topic like black holes, exoplanets or string theory. Ask the President to introduce the speaker. Guarantee an audience by offering extra credit to students for coming, and involve the local press.
4. **Service courses:** Be sure that service courses serve the needs of students enrolled in them by working with departments who require physics.
5. **Departmental advisory committee:** Form a departmental advisory committee that can bring successful alumni and local industrial leaders into the department to interact with faculty members and students.

For University Administrators

1. Recognize that physics has long represented a pinnacle of modern intellectual achievement and an active program is a hallmark of an academically rigorous college or university. Historically the existence of a physics program indicates that a university is serious about academics and can prepare students for competitive graduate programs and challenging careers.
2. Introduce representatives of local industry to the faculty and students in your physics department. Physics majors are both intelligent and hard-working so they make excellent employees and are often impressive examples of student excellence. This is indicated by the fact that unemployment rates among physics graduates are much lower than in many other fields.
3. Pay a visit to the physics department and see the exciting work in teaching and research that is happening there.

For the HBCU Physics Community

1. Form a Council of HBCU Physics Department Chairs to keep one another informed about departmental problems and potential solutions to them and to act as a central point for coalitions of departments for projects in research and teaching.
2. Prepare a major proposal for a research project addressing a grand challenge as identified by the federal government, for example providing renewable energy, that can be most effectively addressed by a collaboration among physics departments at HBCUs.
3. Form a collaboration to institute instructional reform, perhaps developing the use of undergraduate learning assistants, that will both improve student learning of physics and also involve physics undergraduates more directly in the departmental community.

For Funding Agencies

1. Promote recognition that physics departments in HBCUs have produced and still produce more than half of all the African American B.S. graduates in physics.
2. Make sure that HBCU Physics Departments are aware of major proposal solicitations both in research where they have strength and in human capital development. This could be done through the Council of HBCU Physics Department Chairs because some of the HBCUs lack infrastructure to keep faculty informed of such opportunities.
3. Ask program officers to make an extra effort to ensure that HBCU physicists participate in large collaborative projects when they have appropriate expertise.

For Physics Professional Organizations

1. Support both virtual and physical meetings of the Council of HBCU Physics Department Chairs.
2. Take steps to tie HBCU physicists more closely into the larger physics community. For example, provide stipends for HBCU physics faculty to attend the New Faculty Workshops

or reduce registration fees for HBCU faculty in institutions geographically close to a national meeting.

3. Assist in building bridge programs from undergraduate physics programs to graduate programs in physics. Pay special attention to graduate programs at HBCUs as well as those at TWIs (Traditionally White Institutions)

Report on:

**2011 SPIN-UP Regional Workshop for Historically Black Colleges and Universities
Human Capital Development in Physics**

May 13-15, 2011, Hampton, VA

Paul Gueye, James Stith and Quinton Williams

Description of the workshop:

This workshop was the last in a series of regional workshops based on the results of the Strategic Programs for Innovation in Undergraduate Physics (SPIN-UP) project conducted by the National Task Force on Undergraduate Physics and published in 2003. The workshops are a joint project of the American Association of Physics Teachers (AAPT), the American Physical Society (APS) and the American Institute of Physics (AIP) and are funded by the National Science Foundation.

This workshop was tailored to the needs of undergraduate physics programs at Historically Black Colleges and Universities (HBCUs). The chairs of all HBCU physics departments that offer an undergraduate physics major were invited to attend and bring one or two faculty colleagues. The local organizing committee was lead by Paul Gueye and Rashinda Davis of the Hampton University Physics Department. The grant funded travel expenses, and the local organizing committee worked with Tiffany Hayes and Celina Cantrell of the Programs Division at AAPT. The committee worked hard to ensure that attendees' travel expenses were covered and that their accommodation and travel needs were met.

Unlike previous workshops, the Hampton workshop was directed by a steering committee that consisted of Paul Gueye (Physics Department at Hampton University and the Jefferson Laboratory), James Stith (Vice President Emeritus of the American Institute of Physics), and Quinton Williams (Interim Provost and Vice President for Academic Affairs and Student Life and Professor of Physics at Jackson State University). Previous SPIN-UP regional workshops have focused on developing departmental physics programs to better serve their students and the institutions in which they reside. In addition to this goal, the Hampton workshop also promoted collaboration among HBCU departments, considered major projects in research and education where such collaboration would be a benefit, and identified resources from the federal agencies that fund research in physics, and tried to make the case for HBCU physics departments approaching agencies as a consortium.

Eighteen of the thirty-four departments invited to the workshop sent representatives. (The representative from Norfolk State University who had planned to attend could not come due to a last-minute medical issue.) The workshop was also attended by representatives of AAPT, APS, AIP, the Society of Physics Students (SPS), the National Society of Black Physicists (NSBP), the National Science Foundation (NSF), the Department of Energy (DOE), the National Institutes of Health (NIH), and the National Aeronautics and Space Administration (NASA). Dr.

Robert Dixon, Dean of the School of Science at Hampton University, Peter Delfyett, President of NSBP and Chanda Prescod-Weinstein, a member of the board of NSBP also contributed to the workshop. A complete list of attendees is attached to this report as Appendix A, and the program of the workshop is included as Appendix B. Although planning session 2 didn't occur as planned due to time constraints, the questions were discussed in planning session 3. At the end of the workshop, a representative from each department presented measures that the department would take to strengthen its physics programs. These plans are included as Appendix C of this report.

In addition to the individual departmental plans, the workshop identified three major projects for the attention of the HBCU physics community that are discussed below along with the major challenges that motivated them.

Major Challenges Identified

1. Low Undergraduate Enrollments in Physics

Many undergraduate programs that provide the bachelor's degree in physics and that are located at an HBCU are endangered. One of the attending departments had recently had its physics program suspended and at least two others were facing mergers with other departments. Most have seen a significant drop in the number of majors in recent years.

Many physics departments teach large service loads and frequently attract substantial amounts of external funding. For these reasons, in favorable economic times, university administrators have overlooked the small numbers of undergraduates in physics. However, in tough economic times like these, administrators are likely to pay more attention to undergraduate enrollments and, unless they have a good sense of the value the department brings to the institution, they often require programs with small enrollments to justify their existence. Many institutions have requirements for minimum enrollments in courses that are on the order of 7-10 students. It is thus difficult for departments that graduate fewer than five majors a year to make upper division physics courses meet these requirements. Even if programs offer upper division courses every other year, a solution which can be inconvenient for students since they must follow a set schedule to complete their degree requirements, it can be difficult to make the university's minimum class size. To compound departmental difficulties, tough economic times often signal reductions in budgets for state and federal agencies that fund research. It is not surprising that almost every attending department has as one of its goals to increase the number of undergraduates completing a physics major.

Physics departments at HBCUs have a strong track record in producing well-prepared physics majors, and several have strong graduate programs supported by established, externally funded research groups. Undergraduate programs appear to be rigorous. However, according to data provided by Patrick Mulvey of the Statistical Research Center at AIP, for the years 2005 – 2009, only six of the 36 HBCU physics departments for which AIP has data graduated an average of 5 majors a year. All departments in HBCUs averaged 2.7 graduates with a B.S. in physics per year. Yet HBCUs continue to produce more than half of all African American B.S. physics graduates annually.

2. Difficulty in Attracting External Funding

Most HBCUs lack the institutional infrastructure found at R1s and even larger second-tier state universities for approaching federal and state agencies that fund research. Those departments with long established research programs are competitive and receive funding that is equal to or greater than physics departments at similar universities.

Departments felt particularly disadvantaged in the search for funds to support educational research projects. They also mentioned a significant lack of support for scholarships that could be used to attract talented African American students to HBCUs since these students are heavily recruited by other physics departments.

3. Lack of recognition of the value of physics and physics research

Administrators at the various HBCUs sometimes fail to recognize the importance of having an active physics program at their institution. The blind spot often extends to other STEM disciplines. Physics also has a problem because there are no jobs for graduates with a bachelor's degree in physics clearly labeled "physicist." This problem is by no means unique to physics departments at HBCUs, but it impacts departments' ability to recruit students into their undergraduate programs. Press coverage of the physics often focuses on large institutions like the national laboratories rather than the work done locally. It is essential that the university community, the public and governmental agencies recognize the importance of physics in promoting the discoveries that build growing economies and widespread prosperity.

A second related problem is the lack of departmental contact with high school teachers who often influence students' choices of college majors. There are very few well-prepared African-American high school physics teachers, a problem which several of the departments are trying to address. Less than 2% of all high school physics teachers nationwide are African American. Additionally, several HBCUs that had a history of producing African American high school physics teachers have lost their programs which further compounds the problem.

4. Lack of Communication

Physics departments in HBCUs share many common problems. However, they have no tradition of, or structure for, sharing ideas to solve them. Traditionally, they have not collaborated in seeking funding to support major initiatives in research or education across several campuses.

Many of the physics departments at HBCUs are not linked or have access to the physics professional societies well enough to be aware of the resources available to them and their students through AAPT, APS, and SPS. For example, most APS divisions have programs to support undergraduate students' attendance at national meetings to present their research, and SPS makes grants to chapters to support local projects.

Although the large departments with graduate programs have a strong tradition of seeking external funding, smaller undergraduate departments often lack experience in preparing proposals for federal and state funding, and faculty may be unaware of the resources available through the different agencies.

5. Lack of Resources Within the Department

Physics departments at HBCUs often have much smaller operating budgets than the norm for all physics departments. Faculty generally have teaching loads roughly equivalent to 12 or more credit hours per semester, and they have a strong tradition of working individually with students. Undergraduate departments do not have teaching assistants so faculty must setup and teach their own labs and conduct their own problem sessions. Also, there is usually very little credit provided for mentoring undergraduate research projects when it comes to promotion and tenure. This situation seriously impedes their ability to maintain active research programs.

Although physics programs can be changed with little money and it is possible to obtain external funding for laboratory equipment and other supplies, reforms place demands on faculty time if only for planning. Therefore, if physics departments are to take action to improve their undergraduate programs, a mechanism must be found and implemented to free faculty time for this work.

Proposals for Action to Meet These Challenges

In the final planning session of the workshop, participants split into three groups. Each group addressed an individual topic: communication, education or research. All groups focused on actions that might be taken by the physics community at HBCUs in collaborations among departments and with the funding agencies and the physics professional societies.

Action 1: Improve Communications

All participants at the workshop agreed that it will be important for HBCU physics departments to work together. Even if they don't collaborate on research or major education projects, there was a consensus that these departments could learn from one another and needed to know the resources available within each department and to exchange information on resources that have become or about to become available. It was also suggested that undergraduate departments consider bridge programs between their departments and HBCUs with PhD programs.

This working group decided to establish a Council of HBCU Physics Department Chairs. The current plan is for this Council to meet once a quarter using web video conference. Paul Gueye of Hampton University will oversee this effort. Texas Southern University will host the website for the Council that will contain information on the virtual meetings and other relevant information. Carlos Handy, chair of the physics department at Texas Southern University will coordinate this effort locally. Beth Cunningham, Executive Officer of AAPT, agreed to use the Webex Video Conferencing System available to her through AAPT to facilitate the quarterly meetings. The Council should soon be in a position to exchange information about individual departments as well as engage in developments on the national level.

In addition, the group will need face-to-face meetings. A consensus indicated that such a meeting would be needed every year or two. The natural venue for such meetings is the annual NSBP meeting. Other ideas include putting departmental profiles on the Council website, working to facilitate the transfer of students from undergraduate departments where a program has been closed to another HBCU, and providing funding for HBCU faculty to attend the annual New Faculty Workshop.

Attendees also cited the importance of interacting more closely with the college/university administrators. They cited the importance of providing administrators with the knowledge and data that would allow them to be better advocates for physics with the federal and state agencies and to better understand the unique nature of the physics field. Increasing efforts in public relations within all institutions was considered a key element in this effort.

Finally, HBCUs and the physics professional societies must find ways to increase the interaction between faculty and students at HBCUs and the larger physics community. This increased activity will enrich the experience of the entire community.

Action 2: Collaborative Research Projects

Quinton Williams, facilitator of the group and interim provost and vice president for academic affairs at Jackson State University, proposed that HBCU physics departments form a coalition to respond to one of the grand challenges identified by the federal mission agencies. He suggested that a study of renewable energy, including research on new ways of providing energy as well as on environmental impacts and other issues of sustainability, would use the research expertise of physicists at HBCUs many of whom work in materials and condensed matter physics. Departments that are less research intensive could contribute expertise in human capital development for the field.

It was pointed out by the DOE representative that any major proposal from a group of HBCUs would have to clearly demonstrate the need for a coalition of departments. Furthermore, the proposal would have to clearly outline how the project would be managed along with a detailed plan for accountability and a way to provide a succession of leadership. To benefit undergraduate physics programs, it will be important that undergraduate students, as well as graduate students, be involved in the research. It is also important that each department in the collaboration receive funding directly to reap the fully intended impact. Also, indirect cost policies at some institutions might lead to additional funds flowing into physics departments.

There is little doubt that obtaining major funding for a coalition of physics researchers at HBCUs would provide needed stimulation to these departments and potentially strengthen their production of undergraduate majors.

Because such a major collaborative proposal will require working out the details of the research and the management structure for it, the consensus of the group was that the next step would be to submit a proposal for a planning grant either to one of the federal agencies, probably the Department of Energy, or to a major foundation. Quinton Williams will spearhead this effort, and Charles Weatherford of Florida A&M University will explore the possibility of contacting one of the major foundations.

Action 3: A Collaborative Project in Undergraduate Education

A key issue in human capital development is strengthening undergraduate education both for physics majors and students who are taking physics because it is required for their majors or to fulfill their general education science requirement. In addition to work in individual departments as outlined by the departmental plans in Appendix C, the discussion focused on the possibility of a collaborative effort among several departments.

One model for such a collaborative effort would be the use of undergraduate learning assistants, which has a number of advantages. First, the project offers opportunities for collaboration among departments on such activities as a training program for the learning assistants or developments of project-based laboratories that could be facilitated by learning assistants. A second major benefit would be the assistance that the learning assistants could provide to faculty thereby freeing them to conduct research or develop new educational materials. There are a number of departments where upper division physics majors successfully run lab sections without direct faculty supervision.

The first step in preparing a major collaborative proposal is to determine the unique needs of HBCU physics departments. Wilbur Walters, chair of the physics department at Jackson State University will take the lead in getting a group together to identify needs and determine exactly what needs to be done.

Summary

The proposed actions offer a genuine opportunity to strengthen undergraduate physics programs at HBCUs. It is clear that these departments need to take immediate action to save the weaker among them who are currently facing abolition, and to provide additional vigor to those that are already strong.