The United States faces a pressing need to increase the size and the diversity of its science, technology, engineering, and mathematics (STEM) workforce. Some students with the potential to become excellent members of the STEM workforce may choose to pursue degrees in other majors due to a lack of awareness of the nature and the financial remuneration available for those equipped with a bachelor’s degree in physics. This is especially true for careers that are well suited for students with a physics background but lie outside of academe. These are issues of great interest and concern to the American Institute of Physics (AIP) and are critically important to the students served by AIP’s organizations for physics students and alumni: the Society of Physics Students (SPS) and Sigma Pi Sigma. The AIP Statistical Research Center (SRC) has monitored the demographics of the education and careers of physicists for decades, and SPS, housed in the AIP Education Division, has developed programs such as the Careers Using Physics website, the Hidden Physicists project, and the Future Faces of Physics endeavor to address this ignorance and encourage the physics community to be more welcoming to all students.

The National Science Foundation (NSF) shares these concerns and on 13 September 2010 awarded a grant of nearly $200,000 to fund a joint project of the SRC and the Education Division entitled, “Expanding the STEM Workforce by Equipping Physics Bachelors Degree Recipients and their Departments to Address the Full Range of Career Options,” AKA “Career Pathways.” (See http://www.nsf.gov/awardsearch/showAward.do?AwardNumber=1011829 for details.)

Historically, physics has often been perceived as a very narrow major, largely preparing specialists for academic careers in physics. However, the scope of physics is the study of the entire physical world. The study of physics provides a foundation from which bachelor’s degree graduates often move directly into STEM positions in fields from engineering to nongovernmental service organizations, to information technology services, to a wide variety of industrial positions. Figure 1 illustrates that of all the students who graduate with a bachelor’s degree in physics, approximately 40% find employment within a year of graduation, while most of the remainder immediately pursue further studies. As Fig. 2 demonstrates, nearly three quarters of these graduates find positions in STEM fields. In speaking with physics faculty, we have learned that while many consider themselves well prepared to advise their students on further academic study, fewer deem themselves prepared to advise their students on seeking STEM employment. The Career Pathways Project seeks to aid students directly and indirectly through their faculty mentors and departmental support networks.

Over the course of three years, the Career Pathways team is conducting site visits to physics departments with strong records of preparing students with bachelor’s degrees in physics and placing them into careers in STEM fields. The goal is to discern and disseminate successful practices for the preparation of physics undergraduates for STEM career pathways. This information is being used to establish a basis for the development of “effective practices” that may be used as a reference by departments across the country. Key components of the project include a pilot program of alumni advisory boards, preparation of summary materials for distribution on the web, and regional workshops at SPS zone meetings for faculty and current undergraduates. This program seeks to break through misconceptions of the opportunities available to those who have earned a bachelor’s degree in physics, draw more students into the
The third piece of the Career Pathways Project is a pilot program, the Alumni Board on Careers, that would interact with faculty and students on careers and career-related issues. Current efforts are focused on aiding participating schools in recruiting board members and setting agendas for board activity.

A commitment to a more diverse STEM workforce is central to the project. Earlier this year, a special opportunity arose. In the absence of an annual meeting of the National Society of Black Physicists (NSBP), the NSBP recommended that its student members attend the 2012 Quadrennial Physics Congress, precisely the meeting at which the first results of the Career Pathways Project would be made public. This should be an excellent opportunity to recruit students for the upcoming Career Pathways regional workshops, both to attend and to recruit their classmates to attend, especially students from historically black colleges and universities (HBCUs). In collaboration with the NSBP, the principal investigators requested and received a supplementary grant from NSF to support the attendance of forty students from HBCUs. At the congress and in the regional workshops, both to attend and to recruit them to attend, especially students from historically black colleges and universities (HBCUs), the project will occur at the 2012 Quadrennial Physics Congress hosted by Sigma Pi Sigma. Roman Czujko of the AIP Statistical Research Center will lead a workshop on “Connecting Students with the ‘Right’ Career Path.” This workshop will focus on helping students to assess their career-ready skills and learn which effective practices of physics departments attendees would most like to see their departments act upon. Beyond the congress, plans are underway to organize a number of three-hour faculty/student Career Pathways workshops in conjunction with the regional spring 2013 SPS zone meetings. The Career Pathways Project has attracted the favorable attention of the American Association of Physics Teachers (AAPT). There will be a Career Pathways Faculty Workshop at the Summer 2013 AAPT Meeting in Portland, Oregon (as well as a session of talks on the project), and AAPT plans to cosponsor a session of talks on the project at the 2013 American Physical Society (APS) April Meeting.

While this remains a time of economic uncertainty, STEM careers continue to be available to those with scientific training and the tools to effectively apply for such positions. Many physics departments have found effective practices to equip their students for these STEM positions. The Career Pathways Project is poised to make these practices widely known. We look forward to ever-greater success for physics undergraduates seeking to enter rewarding, meaningful STEM careers.

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**Field of Employment for Physics Bachelor’s in the Private Sector, Classes of 2009 & 2010 Combined**

![Image](image.png)

**Fig. 2:** A synopsis of the fields in which physics bachelor’s degree graduates find employment within a year of graduation. Image courtesy of the AIP Statistical Research Center.

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Radiations Fall 2012
Douglas Osheroff has led an extraordinary life of discovery and service. On Friday, 27 April 2012, Sigma Pi Sigma recognized Dr. Osheroff as its newest honorary member for his enormous contributions to the advancement of human knowledge of the natural world and the nurturing of physics students and young scientists. Honorary membership may be bestowed only by a vote of the SPS National Council.

Doug Osheroff grew up in the scenic Pacific Northwest logging town of Aberdeen, WA, the son of medical professionals who encouraged his interests that progressed from gardening and photography, to riskier mechanical, chemical, and electrical projects. He had the privilege of studying at CalTech when Richard Feynman taught the introductory physics course, now immortalized in the Feynman Lectures on Physics. Pursuing condensed matter studies in graduate school at Cornell University, diligent effort, along with the unusual circumstances of a skiing accident, positioned him perfectly to be the first person to observe superfluidity in helium-3, at 2:00 in the morning. There, he also met his life partner, the brilliant biochemist Phyllis Liu-Osheroff.

After graduate school, the Osheroffs moved to New Jersey, where Phyllis conducted research at Princeton University and Doug joined the staff of Bell Laboratories. In that highly collaborative environment, he continued his studies of helium-3, first in the liquid state and later in the solid, mapping out the phase diagram and identifying the microscopic states. The couple moved back to the West Coast, where Phyllis joined biotech powerhouse Genentech and Doug joined the physics faculty of Stanford University. He proved to be an outstanding teacher and mentor, in addition to being a premier research scientist. In 1996, Osheroff, his thesis supervisor David Lee, and Cornell colleague Robert Richardson received the Nobel Prize “for their discovery of superfluidity in helium-3.”

Since winning the prize, Dr. Osheroff has crisscrossed the world sharing his scientific breakthroughs and his experiences as a scientist and a scientific citizen. He was a member of the National Task Force on Undergraduate Physics, which issued the SpinUP report on the effective practices of thriving physics departments. Physics enrollments that were at a low point when the report was released, have since climbed to record levels. He also served on the Columbia Accident Investigation Board, convened after the space shuttle Columbia disintegrated during re-entry in 2003. He has partnered with AIP and SPS in a program bringing Nobel laureates to minority serving institutions and SPS zone meetings across the nation. His first purchase with Nobel funds was a new camera, and he continues to enjoy his childhood passion for photography personally and by teaching a first-year seminar on photography.

The Osheroffs brought their spirit of scientific adventure and service to the SPS spring zone meeting for California, Nevada, and Hawaii (via teleconference), held at the California State University at Fresno. On Friday night, Doug spoke to a large community audience about the Columbia investigation, and on Saturday, to the SPS students about discoveries in science, including his own experiences. The opening event of the meeting was Dr. Osheroff’s honorary membership recognition. His citation reads:

For his discovery of the superfluid state of helium-3, his work to advance physics education as a member of the National Task Force on Undergraduate Physics, his crucial scientific contributions as a member of the space shuttle Columbia Accident Investigation Board, and his commitment to welcome all persons to the profession of physics as expressed by his selfless service in a program bringing Nobel laureates to physics student meetings on the campuses of minority serving institutions, Douglas D. Osheroff is elected an Honorary Member of Sigma Pi Sigma, its highest recognition.
Congratulations to the Newest Sigma Pi Sigma Chapters

Trinity College, Hartford, CT, 22 April 2011
Six undergraduates were received as members of Sigma Pi Sigma at Trinity College. It was the first reception at Trinity in 38 years. SPS/ΣΠΣ Assistant Director Thomas Olsen presided at the reactivation of the chapter.

Augustana College, Sioux Falls, SD, 4 May 2011
Twelve undergraduates and two professors formed the charter Sigma Pi Sigma class at Augustana College. Past President of Sigma Pi Sigma Steve Feller presided at the installation.

University at Buffalo, Buffalo, NY, 20 November 2011
Five undergraduates formed the charter Sigma Pi Sigma class at the University at Buffalo. Sigma Pi Sigma President Diane Jacobs presided at the installation.

Calvin College, Grand Rapids, MI, 10 December 2011
Eight undergraduates formed the charter Sigma Pi Sigma class at Calvin College. SPS/ΣΠΣ Assistant Director Thomas Olsen presided at the installation.

Kenyon College, Gambier, OH, 9 December 2011
Eight undergraduates and two professors formed the charter Sigma Pi Sigma class at Kenyon College. Sigma Pi Sigma President Diane Jacobs presided at the installation.

Massachusetts College of the Liberal Arts, North Adams, MA, 13 April 2012
Nine undergraduates formed the charter Sigma Pi Sigma class at the Massachusetts College of the Liberal Arts. SPS Program Coordinator Kendra Redmond presided at the installation.

Gordon College, Wenham, MA, 16 April 2012
Thirteen undergraduates formed the charter Sigma Pi Sigma class at Gordon College. SPS/ΣΠΣ Assistant Director Thomas Olsen presided at the installation.

California State University - Fresno, Fresno, CA, 27 April 2012
Fourteen undergraduate and graduate students were received as members of Sigma Pi Sigma at the California State University at Fresno. It was the first reception at Cal State Fresno in 23 years. SPS/ΣΠΣ Assistant Director Thomas Olsen presided at the reactivation of the chapter. The celebration was held in conjunction with the SPS Zone 18 Meeting, and keynote speaker and Nobel Laureate Douglas Osheroff was received as an Honorary Member of Sigma Pi Sigma.

National University of Singapore, Singapore, 6 June 2012
Twenty-five undergraduates formed the charter Sigma Pi Sigma class at the National University of Singapore. National University became the first Sigma Pi Sigma chapter outside the United States, inaugurating the society’s international era. The event was celebrated in conjunction with seminars on and observations of the Transit of Venus that day. Sigma Pi Sigma Chapter Advisor Phil Chan (of the At-Large chapter, 1991) presided at the installation of the chapter.
During the spring 2012 Sigma Pi Sigma induction ceremony at Angelo State University, San Angelo, TX, three former physics faculty members were honored. Dr. H. Ray Dawson, Dr. David H. Loyd, Jr., and Dr. C. Varren Parker were presented with Sigma Pi Sigma Outstanding Service Awards for their outstanding dedication and support of Sigma Pi Sigma at Angelo State University and their commitment to the success of the Angelo State Department of Physics.

These individuals were thanked for their long-term dedication as professors—their summative service to the department is well over one hundred years. As faculty, they took the extra time to excite physics students to go beyond what was expected, evidenced by a long list of successful graduates in a wide variety of career paths. In their commitment to the longevity and success of the physics department, these professors taught many service courses voluntarily, on top of their full load of majors courses, in an effort to sustain the major.

These three men, exhibiting unparalleled foresight, created the environment and curriculum that has made the ASU physics department so successful. In addition, they dedicated extra hours to the local Society of Physics Students (SPS) chapter and Sigma Pi Sigma chapter in order to plant the seeds that have grown over the years into the well-founded culture that characterizes the department today. Angelo State SPS and Sigma Pi Sigma are among the most active in the nation.

The three awardees were each presented with a framed certificate from the SPS national office. A plaque with the service award and their names is on permanent display in the Angelo State physics student study lounge.

Chapters are encouraged to recognize notable alumni with the Sigma Pi Sigma Outstanding Service Award. For more information, see: www.sigmapisigma.org/awards/outstanding_service.htm.

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2012 Sigma Pi Sigma Inductees at Angelo State University honor faculty emeriti.
Photo by Terry McCracken.