8:00AM A9.00001 Away from the ivory tower: Real challenges teaching high school physics in an urban environment  

RICHARD STEINBERG, City College of New York — For more than 20 years, I have been a physicist and a science educator, primarily at the college level. My research is on understanding and improving the learning of science, from elementary school science through quantum physics. Since 1999 I have been Professor in the School of Education and the Department of Physics at City College of New York. In that time I have had the privilege of working with hundreds of K-12 students, with over a thousand science teachers in and around New York City, and with even more college science students who are graduates of the city school system. To improve my ability to work with all these groups, I spent my sabbatical as a full time high school physics teacher in a public high school in New York City. For me, it was where the rubber meets the road. In this presentation, I will share experiences as an instructor and researcher from the perspectives of college physics instructor, science teacher educator, and high school teacher. With few exceptions, teachers are taught physics one way, are taught to teach it another, are put in a system where neither approach works, and have their students assessed in a way that promotes instructional strategies at odds with how students learn. I will share both challenges I encountered and what I learned about what works in this environment.

8:36AM A9.00002 Universities Reaching Outwards: Science Education Partnerships with Urban School Systems  

CODY SANDIFER, Towson University — The goals of this talk are to: (1) describe how universities, physics departments, and individual faculty can partner with urban school systems to benefit K-16 students, teacher education programs, and university instructors, (2) summarize research on effective university-school system education partnerships, and (3) offer advice and share lessons learned so that university partners can avoid common pitfalls and maximize the potential for collaborative success. Possible areas of university-school collaboration include resident teachers, curricular review, early teaching experiences, professional development, on- and off-campus science outreach, RET programs, science education resource centers, and others. University-school educational partnerships offer numerous benefits but can be challenging to implement and maintain. Research shows that most successful partnerships possess the following characteristics: mutual self-interest, participant commitment, mutual trust and respect, shared decision-making, information sharing, and ongoing evaluation. K-16 course and curriculum redesign is a specific issue that has its own unique set of contextual factors that impact the project’s chance at success, including available materials, administrative support, formative assessments, pilot-testing and instructor feedback, and ongoing professional development. I have learned a number of lessons in own science education collaborations with the Baltimore City Public School System, which is an urban school system with 200 schools, 84,000 students, and 10,700 teachers and administrators. These lessons pertain to: communication, administrative power, and the structure of the school system; relevant contextual factors in the university and K-12 schools; and good old-fashioned common sense. Specific advice on K-16 science education partnerships will be provided to help universities increase student and instructor satisfaction with their physics and teacher education programs, maintain a positive and mutually beneficial relationship with local schools, and improve science education at all levels of instruction.

Common sense is encouraged, but not required, to attend the invited talk.

9:12AM A9.00003 Meeting Urban Science Students Where They Are: Perspectives from Two Physics Teachers and Four Schools  

ROSALIND ECHOLS, The Science Leadership Academy, Philadelphia PA — The phrase ‘urban education’ tends to be used in ways that suggest we see urban education (and urban students) as a monolithic construct. Often, ‘urban’ indexes children of color, with low levels of academic readiness from low socio-economic status communities in crowded, under-resourced classrooms taught by poorly prepared and/or poorly motivated teachers. While teachers and students in urban schools do face challenges that those in more suburban or rural areas may not, we argue that the differences across urban school contexts, even within the same city, outweigh the similarities. Furthermore, these differences have profound implications for the kind of work urban science teachers must do and the support they need from the science and science education research communities. In this talk, two high school physics teachers with experience in four radically different urban teaching contexts discuss the differences across schools that shape their teaching practice and their students’ learning. Against this backdrop, we’ll address the most common ‘misconceptions’ about inquiry science teaching in urban schools that we’ve encountered among scientists, science education researchers and teacher educators. The presentation will conclude with our synthesis of how scientists and science education researchers can best support urban science teachers and students.

9:48AM A9.00004 Engineering Education in K-12 Schools  

ANNE SPENCE, UMBC Mechanical Engineering — Engineers rely on physicists as well as other scientists and mathematicians to explain the world in which we live. Engineers take this knowledge of the world and use it to create the world that never was. The teaching of physics and other sciences as well as mathematics is critical to maintaining our national workforce. Science and mathematics education are inherently different, however, from engineering education. Engineering educators seek to enable students to develop the habits of mind critical for innovation. Through understanding of the engineering design process and how it differs from the scientific method, students can apply problem and project based learning to solve the challenges facing society today. In this talk, I will discuss the elements critical to a solid K-12 engineering education that integrates science and mathematics to solve challenges throughout the world.

10:24AM A9.00005 Preparing teachers for ambitious and culturally responsive science teaching  

GALE SEILER, McGill University — Communities, schools and classrooms across North America are becoming more ethnically, racially, and linguistically diverse, particularly in urban areas. Against this backdrop, underrepresentation of certain groups in science continues. Much attention has been devoted to multicultural education and the preparation of teachers for student diversity. In science education, much research has focused on classrooms as cultural spaces and the need for teachers to value and build upon students’ everyday science knowledge and ways of sense-making. However it remains unclear how best to prepare science teachers for this kind of culturally responsive teaching. In attempting to envision how to prepare science teachers with cross-cultural competency, we can draw from a parallel line of research on preparing teachers for ambitious science instruction. In ambitious science instruction, students solve authentic problems and generate evidence and models to develop explanations of scientific phenomenon, an approach that necessitates great attention to students’ thinking and sense-making, thus making it applicable to cultural relevance aims. In addition, this line of research on teacher preparation has developed specific tools and generate evidence and models to develop explanations of scientific phenomenon, an approach that necessitates great attention to students’ thinking and sense-making, thus making it applicable to cultural relevance aims. In this presentation, I will share experiences as an instructor and researcher from the perspectives of college physics instructor, science teacher educator, and high school teacher. With few exceptions, teachers are taught physics one way, are taught to teach it another, are put in a system where neither approach works, and have their students assessed in a way that promotes instructional strategies at odds with how students learn. I will share both challenges I encountered and what I learned about what works in this environment.

This research suggests a new model for urban science teacher preparation—one that focuses on developing specific teaching practices that elicit and build on student thinking, and doing so through cycles of individual and collective planning, rehearsal, review, and reflection. In this way, a defined set of science-specific, ambitious and culturally responsive instructional practices can be articulated and taught during science teacher preparation.
11:15AM B38.00001 From Near Extinction to Academic Excellence: The University of Wisconsin-La Crosse Physics Program, GUBBI SUDHAKARAN, University of Wisconsin-La Crosse — A physics department that was on the brink of extinction has been successfully resuscitated into a nationally recognized program at the University of Wisconsin-La Crosse (UW-L). The revitalization efforts included sweeping curricular reforms, aggressive recruitment, and retention of students and faculty. The reforms included the introduction of new academic programs for the majors, new courses for non-majors, a dual-degree program in Physics and Engineering, and opportunities for undergraduate research. The department uses several recruitment techniques which include contacting high school seniors in the region and conducting outreach activities to attract students to the program. In order to sustain and enhance the quality of the program, the department carries out comprehensive assessment of its programmatic goals on a regular basis. The department is also very successful in placing students with bachelor’s degrees in physics in STEM careers at an exceptional rate. The success of the program in recruiting, retention, and career placement can be attributed to a combination of aggressive advising and flexible options designed to meet the needs and career goals of each student. The retention rate in the program is high due to one-on-one advising, involving students in undergraduate research at an early stage, and a very vibrant student society. Due to these initiatives, the department has maintained its growth over the years with 160 majors currently, and 29 majors graduating during the 2011-2012 academic year. Recently, the UW-L Physics Program was selected to receive the 2013 American Physical Society (APS) “Improving Undergraduate Physics Education Award”.

11:51AM B38.00002 Increasing student success1. GAY STEWART, JOHN STEWART, University of Arkansas — A more scientifically literate society benefits all STEM disciplines, as well as society as a whole. It is best realized by better serving all undergraduate STEM students. In better-serving all students, a physics department also benefits. The University of Arkansas, Fayetteville physics department has seen a drastic change in number of majors, the number of students active in research and the number of graduates pursuing graduate work, while also increasing the number of majors who decide to teach. Prior to our involvement with the Physics Teacher Education Coalition, graduation rates had increased by more than a factor of 4 in 4 years. After the increased efforts when we became a part of PhysTEC (http://PhysTEC.org) our graduation numbers doubled again. Specific attention to class policy to impact student learning in introductory courses and strong preparation of the graduate teaching assistant and quality advising were our primary areas of emphasis. What worked to build these numbers and strengthen these resources at Arkansas will be discussed.

1This work was supported in part by the National Science Foundation and through the Physics Teacher Education Coalition.

12:03PM B38.00003 SPIN-UP Regional Workshops: Enhancing Undergraduate Physics Programs, ROBERT HILBORN, American Association of Physics Teachers, RUTH HOWES1, Marquette University, KENNETH KRANE, Oregon State University — Through a grant from the National Science Foundation Division of Undergraduate Education (0741560), the American Association of Physics Teachers has been hosting a series of regional workshops for teams of faculty members from physics departments across the country. The goal of the program is to help departments develop and implement plans to enhance their undergraduate programs for both majors and non-majors. We give a brief overview of the Strategic Plans for Innovations in Undergraduate Physics (SPIN-UP) effort, the characteristics of “thriving undergraduate physics programs” articulated in the SPIN-UP report, and the six regional workshops. We provide data on physics majors’ enrollment and graduation data at the participating departments to assess the impact of the program.

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12:15PM B38.00004 SPIN-UP Regional Workshops: Texas Physics Programs and Physics Programs at HBCUs, BETH CUNNINGHAM, American Association of Physics Teachers, PAUL GUEYE, Hampton University, MICHAEL MARDER, University of Texas-Austin, JAMES STITH, American Institute of Physics, QUINTON WILLIAMS, Jackson State University — As part of the broader SPIN-UP Regional Workshops program, the American Association of Physics Teachers organized two workshops directed at specific audiences. In May 2011, Hampton University hosted a SPIN-UP workshop focusing on physics programs at Historically Black Colleges and Universities. In May 2012, the University of Texas at Austin hosted a workshop focusing on physics programs in Texas, many of which were affected by a decision of the Texas Higher Education Coordinating Board to eliminate degree programs (in all fields) that produced fewer than five majors per year averaged over the most recent three-year period. We will summarize the discussions at these meetings and what is being done to respond to the challenges faced by the physics departments attending the workshops.

12:27PM B38.00005 Learning by doing at the Colorado School of Mines, THOMAS E. FURTAK, TODD G. RUSKELL, Colorado School of Mines — With over 260 majors, the undergraduate physics program at CSM is among the largest in the country. An underlying theme in this success is experiential learning, starting with a studio teaching method in the introductory calculus-based physics courses. After their second year students complete a 6-week full-time summer course devoted to hands-on practical knowledge and skills, including machine shop techniques, high-vacuum technology, applied optics, electronic control systems, and computational tools. This precedes a two-semester laboratory sequence that can be taught at an advanced level because of the students’ experience. The required capstone senior course is a year-long open-ended challenge in which students partner with members of the faculty to work on authentic research projects, teaming with grad students or post-docs as contributing members to the department’s externally funded scholarship. All of these features are important components of our B.S. degree, Engineering Physics, which is officially accredited by ABET.

12:39PM B38.00006 Physics Teacher Preparation as a Means for Growth1. RON HENDERSON, Middle Tennessee State University — Physics departments across the country are experiencing pressures to increase the number of graduates. One response is to improve marketing and recruiting efforts to add students to existing pipelines. A more innovative approach is to create new pathways tied to career paths that are alternatives to graduate school. One occupation that currently needs more graduates than physics departments are supplying is physics teaching. About 3 years ago, MTSU began implementing a strategy to prepare physics majors for careers in high school teaching. These efforts included developing coursework specifically related to physics teaching, creating relationships with the college of education, moving to pedagogies that reflect physics education research (PER)-validated best practices, hiring a tenure-track PER expert, implementing new ways to reach potential majors, and seeking external funding. The cumulative result has not only added a number of physics teaching majors to our roles, but has affected our existing programs in a manner that has yielded further growth.

1Support provided by the APS/AAPT PhysTEC project.
12:51PM B38.00007 Positive Aspects and Challenges Associated with Program Growth in Towson University’s Physics Department, DAVID SCHAEFER, Towson University — Towson University’s physics department has experienced dramatic growth over the past five years. Many directed and strategic initiatives have been implemented to increase student enrollment and retention. This has resulted in an increase from approximately 60 majors in 2007 to 115 in 2012. Graduation numbers have also seen a corresponding increase. This presentation will discuss efforts taken to produce these results as well as information related to the positive and negative aspects of growth. Future directions and plans to deal with challenges encountered will be discussed.

1:03PM B38.00008 Retention at Departments of Physics, RAFAEL MULLER, LUIS ROSA, University of Puerto Rico - Humacao — A thriving physics department is the end result of many actions, taken over time, that results in the development of a sense of community between the faculty and the students. As part of this sense of community, gifted students must receive special attention and innovative ideas must be incorporated to successfully accommodate the needs of these students. We have found that the best retention strategy for gifted undergraduates is the total involvement of them in undergraduate research projects and also the development of leadership in extracurricular activities within the department. A careful employment strategy is needed to secure a faculty committed to the goals of the community.

1:15PM B38.00009 Biological Physics major as a means to stimulate an undergraduate physics program, HERBERT JAEGGER, KHALID EID, JAN YARRISON-RICE, Miami University — In an effort to stress the cross-disciplinary nature of modern physics we added a Biological Physics major. Drawing from coursework in physics, biology, chemistry, mathematics, and related disciplines, it combines a broad curriculum with physical and mathematical rigor in preparation for careers in biophysics, medical physics, and biomedical engineering. Biological Physics offers a new path of studies to a large pool of life science students. We hope to grow our physics majors from 70-80 to more than 100 students and boost our graduation rate from the mid-teens to the mid-twenties. The new major brought about a revision of our sophomore curriculum to make room for modern topics without sideling fundamentals. As a result, we split our 1-semester long Contemporary Physics course (4 cr hrs) into a year-long sequence Contemporary Physics Foundations and Contemporary Physics Frontiers (both 3 cr hrs). Foundations starts with relativity, then focuses on 4 quantum mechanics topics: wells, spin 1/2, oscillators, and hydrogen. Throughout the course applications are woven in whenever the opportunity arises, e.g. magnetism and NMR with spin 1/2. The second semester Frontiers explores scientific principles and technological advances that make quantum science and resulting technologies different from the large scale. Frontiers covers enabling techniques from atomic, molecular, condensed matter, and particle physics, as well as advances in nanotechnology, quantum optics, and biophysics.

1:27PM B38.00010 Design of an Experimental Contemporary Physics Course which Develops the Full Experience of Scientific Research and Highlights Current Faculty Research, JAN M. YARRISON-RICE, HERBERT JAEGGER, KHALID F. EID, Physics Department, Miami University, Oxford, OH 45056 — From background literature searches and reading, to conducting experiments, to presenting results and writing a journal manuscript, Miami University has revised its second-year Experimental Contemporary Physics Course, Phy293, to follow a basic research model. We examined research that faculty were conducting and chose experiments which were strongly related to understanding the scientific frontier in the Department and recent 21st century physics. Experiments often had common instrumentation and data analysis techniques which allowed for grouping them into 3 basic categories: 1) Spectroscopy of gases and solids, 2) Characterization of contemporary samples, and 3) Quantized systems in electronic, magnetic and nuclear physics. These experiments also supported our secondary goal of preparing students to enter our research laboratories. At Miami, we generally have between 25-35 second year students, so the laboratory course must be managed to maintain groups of 2-3 for the best student learning outcomes. We will report on course logistics, the grouping of experiments, and methods for assessing students’ learning. Having run the revised, full experimental format of Phy293 a 3rd time, we feel confident stating that this course demonstrates to students “how physics research in the 21st century is actually conducted!”

1:39PM B38.00011 Development of the Future Physicists of Florida, A. WADE, University of West Florida, C. WEATHERBACH, Florida A&M University, P. COTTLE, Florida State University, S. FANNIN, Lincoln High School, W. ROBERTS, Florida State University, M. FAUERBACH, Florida Gulf Coast University, L. PONTI, Augusta Raa Middle School, J. SEAR, The School of Arts and Sciences — We present the development of the “Future Physicists of Florida” (FPF) comprised of Florida university physics professors, middle and high school science teachers, and backed by the Florida Legislature. Our purpose is to address the lack of incoming college freshmen ready and willing to become physics majors. We will discuss the building of FPF and the development of a pipeline for middle and high school students predicted to produce the optimal number of bachelor’s degrees in STEM. We will also discuss our use of community-building activities to educate the students, and their parents and teachers about the educational value of taking physics before going to college and potential careers in physics, to entertain them with fun physics related activities in order to peak their interest in physics, and to ultimately inspire the students to become physicists.

1:51PM B38.00012 A Thriving and Innovative Undergraduate Experiential Physics Program, BAHRAM ROUGHANI, Kettering University — The thriving physics program at Kettering University has experienced a three-fold increase in the number of physics majors since 2002. Our unique physics program requires students alternate between on-campus academic terms and off-campus co-op work terms on a three months rotation format to complete their degree in 4.5 years that includes summer as either school or co-op term. Students complete a minimum of five terms (~15 months) of cooperative work terms, and two terms (~6 months) of senior thesis work. The IP of the thesis work done at a co-op site belongs to the company. This has attracted co-op sponsors for our program by removing the IP concerns. The cooperative and experiential education part of our program is required for graduation, without any credits assigned to it. At the end of every co-op term students’ work performance is evaluated by their co-op supervisor, which should match expected performance standards. In addition to co-op and thesis, our programs include a senior capstone design project course, concentrations within physics (Acoustics, Optics, and Materials), a required technical sequence outside physics, as well as entrepreneurship across curriculum. The success of our student securing the highest paid jobs for undergraduate physics majors in the nation plus their success in graduate studies are the main “Pull Factors” that has lead to three fold increase the physics majors since 2002.

2:03PM B38.00013 A capstone research experience for physics majors, DAVID JACKSON, Dickinson College — Dickinson College is a small liberal arts college with a thriving physics program. For years, one of the key features of our program has been a year-long senior research project that was required for each student. Unfortunately, as our number of majors increased, it became more and more difficult to supervise such a large number of senior research projects. To deal with this growing challenge, we developed a capstone research experience that involves a larger number of students working together on an independent group project. In this talk I will give a broad overview of our new senior research model and provide a few examples of projects that have been carried out over the past few years. I will also briefly describe the positive and negative aspects of this model from the perspective of faculty and students.
2:30PM C38.00001 Parallel Performance Analysis between Free Response Environments and the Force Concept Inventory in Introductory Mechanics Courses. NICOLE BOBBITT, AARON WADE, CHANDRA PRAYAGA, University of West Florida — This paper reports our attempts to: 1) create a problem solving situation that folds in both kinematics and force discussions 2) find a way to model and predict common thought processes that cause typical misconceptions identified by the Force Concept Inventory (FCI). Two pen and paper test questions were designed with these goals in mind, both broken into specific elements to arrive at a quantifiable fragmentation of the necessary thought processes required to solve the problem. These results were compared to pre- and post-FCI data to analyze the common misconceptions as defined by FCI. The data was analysed using factor analysis to group performance across the two environments. Two styles of grading were used to highlight the effectiveness of this method: immediately this, and any future questions, would become a tool in the classroom to pinpoint the critical ideas with which a typical student struggles during an introductory mechanics course.

2:42PM C38.00002 Using a flipped classroom in an algebra-based physics course. LEIGH SMITH, University of Cincinnati — The algebra-based physics course is taken by Biology students, Pre-Pharmacy, Pre-Medical, and other health related majors such as medical imaging, physical therapy, and so on. Nearly 500 students take the course each Semester. Student learning is adversely impacted by poor math backgrounds as well as extensive work schedules outside of the classroom. We have been researching the use of an intensive flipped-classroom approach where students spend one to two hours each week preparing for class by reading the book, completing a series of conceptual problems, and viewing videos which describe the material. In class, the new response system Learning Catalytics is used which allows much richer problems to be posed in class and includes sketching figures, numerical or symbolic entries, short answers, highlighting text, etc in addition to the standard multiple choice questions. We make direct comparison of student learning for 1200 students who have taken the same tests, 25% of which used the flipped classroom approach, and 75% who took a more standard lecture. There is significant evidence of improvements in student learning for students taking the flipped classroom approach over standard lectures. These benefits appear to impact students at all math backgrounds.

2:54PM C38.00003 The Use of Research-Based Instructional Strategies in Introductory Physics: Where do Faculty Leave the Innovation-Decision Process?1, CHARLES HENDERSON, Western Michigan University, MELISSA DANCY, University of Colorado Boulder, MAGDALENA NIEWSIADOMSKA-BUGAJ, Western Michigan University — During the Fall of 2008 a web survey was completed by a representative sample of 722 United States physics faculty. In this talk we will briefly present summary statistics to describe faculty knowledge about and use of 24 specific research-based instructional strategies (RBIS). We will then analyze the results based on a four stage model of the innovation-decision process: knowledge, trial, continuation, and high use. The largest losses occur at the continuation stage, with approximately 1/3 of faculty discontinuing use of all RBIS after trying one or more of these strategies. This results suggest that common dissemination strategies are good at creating knowledge about RBIS and motivation to try a RBIS, but more work is needed to support faculty during implementation and continued use of RBIS. Based on logistic regression analysis, only two potential predictor variables measured were statistically significant when controlling for other variables. Faculty age, institutional type, and percentage of job related to teaching were not found to be correlated with knowledge or use at any stage. High research productivity and large class sizes were not found to be barriers to use of at least some RBIS.

3:06PM C38.00004 Wikispaces (Wikis) and Group Problem Solving (GPS) sessions in Physics classes. HASHINI MOHOTTALA, University of Hartford — We report the combine use of Wikispaces (Wikis) and Group Problem Solving (GPS) sessions conducted in the introductory level and upper level physics classes. This method gradually evolved from the combine use of Wikis and Just in Time Teaching (JITT) practiced over the past years. As a part of this new teaching method, some essay type problems, parallel to the chapter in discussion, were posted on the Wikis at the beginning of each week and students were encouraged to visit the pages and do the work without providing numerical final answers but the steps. At the end of each week students were evaluated on the problem solving skills opening up more opportunity for peer interaction by putting them into small groups and letting them solve one selected problem. A class of 30 students is divided into 6 groups and as a whole four lengthy essay problems are discussed - each group is given to solve one problem. The problem numbers are drawn in a raffle and the groups are excited to find out what they get each week. The required skills to solve a problem are gained from the weekly given Wiki exercises. Wiki provides a user-friendly platform to make this effort a success. GPS sessions help the professor identify the failing students earlier and help them before it’s too late.

3:18PM C38.00005 Computer-based, Jeopardy™-like game in general chemistry for engineering majors1. S.S. LING, F. SAFFRE, M. KADADHA, D.L. GATER, A.F. ISAKOVIC, KUSTAR - Khalifa University — We report on the design of Jeopardy™-like computer game for enhancement of learning of general chemistry for engineering majors. While we examine several parameters of student achievement and attitude, our primary concern is addressing the motivation of students, which tends to be low in a traditionally run chemistry lectures. The effect of the game-playing is tested by comparing paper-based game quiz, which constitutes a control group, and computer-based game quiz, constituting a treatment group. Computer-based game quizzes are Java™-based applications that students run once a week in the second part of the last lecture of the week. Overall effectiveness of the semester-long program is measured through pretest-postest conceptual testing of general chemistry. The objective of this research is to determine to what extent this “gamification” of the course delivery and course evaluation processes may be beneficial to the undergraduates’ learning of science in general, and chemistry in particular. We present data addressing gender-specific difference in performance, as well as background (pre-college) level of general science and chemistry preparation. We outline the plan how to extend such approach to general physics courses and to modern science driven electives, and we offer live, in-lectures examples of our computer gaming experience.

1Supported by NSF #0715698.

3:30PM C38.00006 The Physics Learning Center at the University of Wisconsin-Madison. S.M. NOSSAL, L.E. WATSON, E. HOOPER, A. HUESMANN, B. SCHENKÄR, P. TIMBIE, M. RZCHOWSKI, Physics Department, University of Wisconsin-Madison — The Physics Learning Center at the University of Wisconsin-Madison provides academic support and small-group supplemental instruction to students studying introductory algebra-based and calculus-based physics. These classes are gateway courses for majors in the biological and physical sciences, pre-health fields, engineering, and secondary science education. The Physics Learning Center offers supplemental instruction groups twice weekly where students can discuss concepts and practice with problem-solving techniques. The Center also provides students with access on-line resources that stress conceptual understanding, and to exam review sessions. Participants in our program include returning adults, people from historically underrepresented racial/ethnic groups, students from families in lower-income circumstances, students in the first generation of their family to attend college, transfer students, veterans, and people with disabilities, all of whom might feel isolated in their large introductory course and thus have a more difficult time finding study partners. We also work with students potentially at-risk for having academic difficulty (due to factors academic probation, weak math background, low first exam score, or no high school physics). A second mission of the Physics Learning Center is to provide teacher training and leadership experience for undergraduate Peer Mentor Tutors. These Peer Tutors lead the majority of the weekly group sessions in close supervision by PLC staff members. We will describe our work to support students in the Physics Learning Center, including our teacher-training program for our undergraduate Peer Mentor Tutors.
3:42PM C38.00007 Re-Envisioning the Introductory Physics Sequence at Georgia Gwinnett College (GGC), SCOTT J. THOMPSON, KENNETH B. SALES, Georgia Gwinnett College — GGC is a new, 4-year, open-access institution located in the northeast of Atlanta. As an open access college, many of the students who take the introductory physics sequence do not have a strong mathematical background. A large percentage of the students have significant work or family obligations in addition to being full-time students. To better serve these students, the first semester of the trig-based introductory physics sequence was modified in a manner that focuses and structures the material to be completed by the students both outside and inside of class such that the time spent outside of class can be reduced. Specifically, focused notes were provided to the students with an online assignment prior to class in place of reading from a textbook. Class time was then focused on a deeper understanding of the concepts to be covered instead of an initial (or secondary) introduction to the material. Data was collected for specific exam questions and compared with the results from previous classes taught by the same instructors. An overview of the results and observations of the instructors using this method will be discussed.

3:54PM C38.00008 On “Global Warming/Climate Change” — A Critical-Thinking Approach to Analyzing some of the Science while Teaching the Scientific Method, LAURENCE I. GOULD, University of Hartford — Undergraduates tend to learn and enjoy physics through its well-established corpus (mechanics, electricity and magnetism, quantum theory, etc.). However, there is a relatively new opportunity to enhance the learning of physics through critical thinking in a non-traditional area. Such thinking can be fostered through an analysis of both the science and methodology involved in the area commonly known as “global warming/climate change” (AGW). This opportunity arises because of an increasing number of scientists from around the world who have been examining and challenging[1] the apparently dominant claim that dangerous AGW is caused primarily by human-produced carbon dioxide. This talk will go over how such critical thinking works through: (1) two independent-study courses I have done with some physics majors, and (2) a college-wide freshman seminar about AGW (which may encourage students to consider taking more physics courses or even take physics as a Minor or Major).


4:06PM C38.00009 ABSTRACT WITHDRAWN —

4:18PM C38.00010 Sensory mistakes in physics regarding sound, light and radio waves, T.M. BRILES1, A.E. TABOR-MORRIS2, Georgian Court University — Optical illusions are well known as effects that we see that are not representative of reality. Sensory illusions are similar but can involve other senses than sight, such as hearing or touch. One mistake commonly noted among instructors is that students often mis-identify radio signals as sound waves and not as part of the electromagnetic spectrum. A survey of physics students from multiple high schools highlights the frequency of this common misconception, as well as other nuances on this misunderstanding. Many students appear to conclude that, since they experience radio broadcasts as sound, then sound waves are the actual transmission of radio signals and not, as is actually true, a representation of those waves as produced by the translator box, the radio. Steps to help students identify and correct sensory illusion misconceptions are discussed.

1School of Education
2Department of Physics

4:30PM C38.00011 Introducing New Experiments to the Contemporary Physics Lab: Emphasis on Quantum Mechanics Foundations and New Physics Frontiers, KHALID EID, JAN YARRISON-RICE, HERBERT JAEGGER, Miami University — We remodeled our sophomore curriculum extensively both in the laboratories and the lectures. Our Experimental Contemporary Physics laboratory (PHY293) was almost completely re-built both in curriculum and pedagogy. Among the new experiments that we introduced are Nanoparticle plasmon resonance, Saturated absorption and fluorescence in iodine molecules, Quantized conductance in atomic-scale constrictions, and Water droplets behavior and manipulation on metal surfaces. This presentation will focus on the last two experiments. Quantized conductance in a constriction in a gold wire being pulled slowly is a unique direct application of the one-dimensional potential wells. Unlike most experiments on quantum mechanics that use optics, this experiment is transport-based, conceptually simple, and robust in addition to being low-cost. The transport properties of the wire span multiple transport regimes while being pulled. It is quite valuable for students (a significant fraction of whom are biological physics and engineering physics majors) to understand the behavior of water droplets on different surfaces. Water is the medium in which biological activities occur and is important in many other applications like air conditioning and refrigeration. We design simple gradients in the hydrophobic/hydrophilic properties of metal surfaces in order to move water droplets in a controlled way, even against gravity. Students explore the effects of surface tension and metal roughness on droplets.

4:42PM C38.00012 On the Electron Gas Heat Capacity in Undergraduate Solid State, JAVIER HASBUN, University of West Georgia — In undergraduate solid state physics the electronic energy, $U_{el}$, is calculated through the Fermi distribution function while the energy is weighted with the density of states. The electronic heat capacity is the derivative of the electronic energy with respect to temperature. Through this process, it is possible [1] to obtain a low temperature approximation for the heat capacity, $C_{el}$, that's proportional to the temperature. It is of interest to do a numerical calculation of $U_{el}$ from which the numerical $C_{el}$ is extracted. However, the result obtained, while agreeing with the low temperature approximation, has a slope that’s substantially different. The disagreement appears large as the temperature is increased from zero K. Here we show that the reason has to do with the constancy of the Fermi level. By including the self consistent behavior of the chemical potential, the deviation from zero Kelvin is much improved and the result seems to make better sense. The lesson learned is significant enough to be of great pedagogical importance as regards the heat capacity calculation and the behavior of the chemical potential with temperature.


4:54PM C38.00013 Design and operation of an inexpensive far-field laser scanning microscope suitable for use in an undergraduate laboratory course, ARTHUR PALLONE, Norwich University, ERIC HAWK, None — Scanning microscope applications span the science disciplines yet their costs limit their use at educational institutions. The basic concepts of scanning microscopy are simple. The microscope probe - whether it produces a photon, electron or ion beam - moves relative to the surface of the sample object. The beam interacts with the sample to produce a detected signal that depends on the desired property to be measured at the probe location on the sample. The microscope transforms the signal for output in a form desired by the user. Undergraduate students can easily construct a far-field laser scanning microscope that illustrates each of these principles from parts available at local electronics and hardware stores and use the microscope to explore properties of devices such as light dependent resistors and biological samples such as leaves. Students can record, analyze and interpret results using a computer and free software.
5:06PM C38.00014 Simulation and Visualization of Chaos in a Driven Nonlinear Pendulum – An Aid to Introducing Chaotic Systems in Physics

GODFREY AKPOJOTOR, Theoretical and Computational Condensed Matter Physics, Physics Department, Delta State University, Abraka, Nigeria. The presence of physical systems whose characteristics change in a seemingly erratic manner gives rise to the study of chaotic systems. The characteristics of these systems are due to their hypersensitivity to changes in initial conditions. In order to understand chaotic systems, some sort of simulation and visualization is pertinent. Consequently, in this work, we have simulated and graphically visualized chaos in a driven nonlinear pendulum as a means of introducing chaotic systems. The results obtained which highlight the hypersensitivity of the pendulum are used to discuss the effectiveness of teaching and learning the physics of chaotic system using Python. This study is one of the many studies under the African Computational Science and Engineering Tour Project (PASET) which is using Python to model, simulate and visualize concepts, laws and phenomena in Science and Engineering to compliment the teaching/learning of theory and experiment.

5:18PM C38.00015 Incorporating Ideas from Detector Physics into the Physics Curriculum: from HS to College

MISO KOMAROV, BERNARD BOSTON, RODNEY CARMA, ELY LEON, MEL SABELLA, EDMUNDO GARCIA-SOLIS, Chicago State University — The goal of this project is to improve student understanding of modern physics in the undergraduate curriculum by building stronger content knowledge, reasoning and laboratory skills. This project is centered on the development of lab modules that help students move beyond theory and develop an appreciation of modern experimental physics. These modules allow students to build knowledge of subatomic particles by experimenting with detectors made of scintillator plastic, phototubes and read-out electronics. These instructional modules we are developing will permeate throughout the undergraduate curriculum forming a coherent conceptual thread. As students progress through the materials the content will become more challenging as the level of scaffolding decreases. As students complete the conceptual thread they will become versed in nuclear physics experimental techniques. In this talk we introduce the project, the detectors and the lab modules. Module one relates the kinetic energy we study in introductory mechanics to the kinetic energy of sub-atomic particles. Module two relates the principles of electromagnetism and charge from the interaction of magnets and coils to that of a sub-atomic particle moving through a detector.

3This project is supported by the National Science Foundation, grant number DUE-0941034.

Tuesday, March 19, 2013 8:00AM - 11:00AM
Session F38 FEd: Physics Education Programs, Policy and the Media 347 - Aaron Wade, University of West Florida

8:00AM F38.00001 Engaging community college students in physics research

MEGAN VALENTINE, MARIA NAPOLI, ARICA LUBIN, LIU-YEN KRAMER, OFELIA AGUIRRE, University of California, Santa Barbara. JENS-UWE KUHN, NICHOLAS ARNOLD, Santa Barbara City College — Recruiting talent and fostering innovation in STEM (Science, Technology, Engineering and Mathematics) disciplines demands that we attract, educate, and retain a larger and more diverse cohort of students. In this regard, Community Colleges (CC), serving a disproportionate number of underrepresented minority, female and nontraditional students, represent a pool of potential talent that, due to a misguided perception of its students as being less capable, often remains untapped. We will present our strategies to attract and support the academic advancement of CC students in the STEM fields through our NSF-sponsored Research Experience for Undergraduates program entitled Internships in Nanosystems Science Engineering and Technology (INSET). For more than a decade, INSET has offered a physics research projects to CC students. The key components of INSET success are: 1) the involvement of CC faculty with a strong interest in promoting student success in all aspects of program planning and execution; 2) the design of activities that provide the level of support that students might need because of lack of confidence and/or unfamiliarity with a university environment; and 3) setting clear goals and high performance expectations.

8:12AM F38.00002 Pathways to Excellence Scholarship Program for women in STEM fields

JOSEPH DI RIENZI, Notre Dame of Maryland University — Notre Dame of Maryland University (NDMU) has an NSF S-STEM grant, Pathways to Excellence, that gives 10 scholarships annually to academically talented women undergraduates with demonstrated financial need who are pursuing degrees in mathematics, physics, computer information systems, or engineering. NDMU has been cited (Whitten, et al. (2007)) as providing a female friendly environment for the study of physics. In this program we are using a tri-part mentoring system involving a faculty member in the student’s discipline, a peer mentor from the program and an external alumna mentor. The program also has a thematic seminar course for the scholars. Each student in the program is tasked to construct a career development plan in assistance with her faculty mentor and set measured annual goals. In addition, all scholarship students are requested to have an experiential experience. As a result, NDMU aims to strengthen its role in increasing the numbers of well-educated and skilled women employees from diverse backgrounds, including mostly first-generation college students, in technical and scientific areas. Early assessment of the success of the program will be presented as well as modifications that resulted from the formative evaluation.

3This program is funded by a National Science Foundation S-STEM grant which is not responsible for its content.

8:24AM F38.00003 Diversity in Physics: Impact of Using Minimum Acceptable GRE Scores for Graduate Admissions

CASEY W. MILLER, University of South Florida. Department of Physics — About 180 graduate programs in physics are listed in the AIP Graduate Programs book. ~ 96% require the general GRE test; a quarter of these have an explicitly stated minimum score for admission, with the median stated cut-off being 700 (64th percentile) on GRE Quantitative; ~ 48% require the physics GRE; about half of these have an explicitly stated minimum score for admission, with the median being 600 (32nd percentile). It does not seem unreasonable to expect students to be among the top test scorers, until you dissect the test results by race and gender. In this talk, I will present data showing that the use of minimum acceptable scores on the GRE exam will have (have had?) a negative impact on diversity in Physics. I will remind the community that this practice is in opposition to ETS’s Guide to the Use of Scores. I will make some suggestions for admissions committees, based in part on analyses I have performed. I will then pose challenges related to reducing the influence of GRE scores to the community, ranging from the department and university administration, to ranking bodies and professional societies.

1Supported by NSF.
8:36AM F38.00004 Interdisciplinary Research and Education in STEM in a Discipline Dominated Academic Structure—Research and Education at the Cross Roads. SOLOMON BILILIGN, North Carolina A&T State University — Major issues in society - developing alternate sources of energy and a sustainable environment, improving health, and minimizing the effects of climate change require a collective effort by different disciplines working in interdisciplinary groups. Many major breakthroughs in science take place at the boundaries or intersections of disciplines. The need to create a new generation of students who combine a rigorous disciplinary depth with the ability to reach out to other disciplines and work in interdisciplinary teams is more urgent. There is a consensus that the current academic administrative structure is the most important barrier to interdisciplinary collaboration; other barriers like poor communication, etc., emanate from it. How can interdisciplinary education and research flourish while maintaining strong backgrounds in the disciplines? How can universities lower or remove barriers to faculty participation in interdisciplinary education and research and create porous, flexible, less redundant environment that facilitates the flow of ideas, people and resources across disciplinary boundaries? Is possible to have disciplines without disciplinary departments? In this short paper, the barriers and the challenges for developing interdisciplinary education and research will be summarized, lessons from some successful attempts and failures will be presented, and some approaches will be recommended for further discussion.

8:48AM F38.00005 Personifying self in physics problem situations involving forces as a student help strategy. A.E. TABOR-MORRIS1, Georgain Court University — How can physics teachers best guide students regarding physics problem situations involving forces? A suggestion is made here to personify oneself as the object in question, that is, to pretend to be the object undergoing forces and then qualify and quantify those forces according to their vectors for the system at hand. This personification is not meant to empower the object to act, just to sense the forces it is experiencing. This strategy may be especially useful to beginning physics learners attacking problems that involve both multiple forces AND multiple objects, since each object acted upon needs to be considered separately, using the idea that one cannot be two places at once. An example of this type of problem expounded on here is Atwood’s machine: two weights hung over a pulley with a single rope. Another example given is electromagnetic forces on one charge caused by other charges in the vicinity. Discussion is made on implementation of classroom strategies.

9:00AM F38.00006 High School Physics Teacher Outreach Programs at California State University Long Beach1, CHUHEE KWON, GALEN PICKETT, LAURA HENRIQUES, California State University Long Beach — One of the goals of the CSULB PhysTEC project has been to establish a physics teaching community that partners CSULB faculty, high school teachers, pre-service teachers, and physics students. In two years, we have created a solid sustainable Physics Teacher Network with local high school teachers. We will discuss the successful outreach programs for high school physics teachers at CSULB and the detailed logistics. Teacher-In-Residence (TIR), high school physics teachers working with the CSULB PhysTEC team, has provided invaluable input for designing and implementing outreach events. The department organizes biannual open house for local high school teachers and their students. The open house event is attended by pre-service teachers, physics undergraduate and graduate students, and faculty. We also host the monthly demo-sharing day that physics teachers bring and share topical demos, which has about 30 - 50 attendees each month. The CSULB PhysTEC project also distributes a monthly newsletter for local physics teachers with upcoming events and information about teaching, and this newsletter is organized and written by TIR.

9:12AM F38.00007 Using the science of granular materials to engage middle and high school students in the process of scientific enquiry1. JENNIFER PODEL, NALINI EASWAR, Smith College, Northampton, MA, SHUBHA TEWARI, KARL MARTINI, Western New England University, Springfield, MA, KRISTIN DOLCIMASCOLO, Amherst Regional Middle School, Amherst, MA, ERIC NEWMAN, Northampton High School, Northampton, MA — We describe outreach efforts that use the science of granular materials to engage middle and high school physics students in local public schools in scientific investigations. In the middle school, the students were provided with a set of questions, and starting materials to set up their experiments. Examples of investigations pursued by the students include looking at the influence of the size and shape of grains on (i) their rate of flow through a hopper and (ii) their tendency to desegregate in a flow. The high school students were introduced to the properties of granular materials via a series of activities that explored the complex behavior of these materials. Following this, groups of students were challenged to pose a question and design an experiment to investigate a particular aspect of the properties of granular materials. Examples of questions that the students chose to investigate include: How does the shape of grains influence how well they stack in a pile? What factors affect the probability of avalanches down an incline? Both sets of students worked in groups over a period of two months to take quantitative data to test their hypotheses. The investigations culminated in a set of presentations by the students to local faculty and students.

9:24AM F38.00008 Science Days: Graduate Student Run Outreach on a Budget1. JUSTIN K. PERRON2, GEORGE P. LINDBERG, University at Buffalo, Department of Physics, Buffalo, NY 14260 — We will describe a new and ongoing program at the University at Buffalo (UB) aimed at exposing underrepresented K-12 students to the Science Technology Engineering and Math (STEM) fields. This program has an entirely graduate student run effort, from idea to inception and finally through implementation. Graduate students, under supervision from faculty members, received a grant from NYSS-APS and matching funds from Physics, Chemistry, and Biology departments at UB. Graduate students set up an outreach program that buses students from inner city Buffalo to UB campus to participate in STEM-based activities. We have held two three hour events so far. Each event involved ~30 students, 99% of which are from underrepresented demographics. Their responses to brief questionnaires showed overwhelming positive views of the event and their genuine interest in science. We will discuss what has made this program a success including what faculty members have done and can do, to support the effort while still leaving it entirely in the graduate students’ hands.

1This work is supported by the PhysTEC grant.

1Supported by APS Outreach grant and NSF DMR 0820506.

2Supported by APS Outreach grant and NSF DMR 0820506.

3This project is funded by NYSS-APS–Graduate Science Days Award # 62313, The University at Buffalo/Buffalo Public School Interdisciplinary Science and Engineering Partnership Award # DUE-1102998

4Currently at Joint Quantum Institute, University of Maryland, College Park, MD 20742 and the National Institute of Standards and Technology (NIST), Gaithersburg, MD 20889
9:36AM F38.00009 Bringing education to your virtual doorstep. VITALIY KAUROV, Wolfram Research Inc. — We currently witness significant migration of academic resources towards online CMS, social networking, and high-end computerized education. This happens for traditional academic programs as well as for outreach initiatives. The talk will go over a set of innovative integrated technologies, many of which are free. These were developed by Wolfram Research in order to facilitate and enhance the learning process in mathematical and physical sciences. Topics include: cloud computing with Mathematica Online; natural language programming; interactive educational resources and web publishing at the Wolfram Demonstrations Project [1]; the computational knowledge engine Wolfram Alpha [2]; Computable Document Format (CDF) and self-publishing with interactive e-books; course assistant apps for mobile platforms. We will also discuss outreach programs where such technologies are extensively used, such as the Wolfram Science Summer School [3] and the Mathematica Summer Camp [4].


9:48AM F38.00010 A Mobile Nanoscience and Electron Microscopy Outreach Program. TONYA COFFEY, KYLE KELLEY, Appalachian State University — We have established a mobile nanoscience laboratory outreach program in Western NC that puts scanning electron microscopy (SEM) directly in the hands of K-12 students and the general public. There has been a recent push to develop new active learning materials to educate students at all levels about nanoscience and nanotechnology. Previous projects, such as Bugscope, nanoManipulator, or SPM Live! allowed remote access to advanced microscopes. However, placing SEM directly in schools has not often been possible because the cost and steep learning curve of these technologies were prohibitive, making this project quite novel. We have developed new learning modules for a microscopy outreach experience with a tabletop SEM (Hitachi TM3000). We present here an overview of our outreach and results of the assessment of our program to date.

10:00AM F38.00011 The Good, The Bad, and The Ugly: Using Movies to Teach Science. JOANNE BUDZIEN, MacMurray College — Can the plane outrun the explosion? Could the heroes escape injury from the bomb by hiding in the bathtub? Are we in danger of being overrun by 50-foot-tall bugs that have been exposed to radiation? Many people in the general public do want to know the science behind much of what they see in the movies and on television. However, those people are unlikely to take a whole class because "everyone knows" that science classes are boring and irrelevant. On the other hand, an evening with an hour or so of video clips interspersed with explanations of the science can be a big hit both to raise general science fluency and recruit students into general education science classes. Film-editing technology has advanced to the point that anyone who has a computer and is willing to invest a couple days in learning to use the software can make a clips-with-PowerPoint DVD that can be shown to a local audience for discussion or used in a science class to show the exact scenes to save time. In this presentation, I’ll show an example of my work and talk about how you can make your own DVD.

10:12AM F38.00012 The Physics of Babies. PHILIP SHEMELLA, Rensselaer Polytechnic Institute — Since the 2011 birth of my daughter I have been a 100% as a stay-at-home dad and 50% researcher. My “Routine Adventures” in the baby universe are the subject of this fun talk that presents the unique challenges of baby physics. Topics include “Schroedinger’s Baby” and “The Entropy of Rice.”

10:24AM F38.00013 An IYPT-based undergraduate physics tournament in China1. CHUANYONG LI, FENG SONG, YUBIN LIU, QIAN SUN, School of Physics, Nankai University — International Young Physicists’ Tournament (IYPT) is a team-oriented scientific competition of secondary school students. The participants present their solutions to scientific problems they have prepared over several months and discuss their solutions with other teams. It can also be implemented in university level as its physics problems are all open questions and have no standard answers, especially suitable for undergraduates’ ability training in China. The annual tournament of physics learning of undergraduates in our school of physics was started in 2008. Each year, there are 15-18 teams, 20 more student volunteers and 30 more faculty jurors involved. The students benefited in different ways. It is project-based, requiring students to solve the problems in a research way. Team work is developed in both experimenting and discussing stages. The knowledge learned in classrooms can be used to solve these practical and life-related problems, raising their interest and initiative in physics learning. Finally, they are building up their skills in scientific presentation and communication. An IYPT-based program called CUPT (China undergraduate physics tournament) was launched in 2010 and annually attracts about 40 universities to attend. It gains its important role in physics education.

1National Fund for Talent Training in Basic Sciences (J1103208)

10:36AM F38.00014 Met The Press: What It’s Like to Talk to Reporters about Physics. REBECCA THOMPSON, American Physical Society — Someone from the Huffington Post just called you because they are doing a story about science and you are a physicist. The problem is that they need you to take time away from your graphene experiments to talk about the physics of exploding anvils. It’s been a long time since you’ve shot an anvil in the air so you think you might not be right for this. But, as long as you understand general physics and can explain things well, you can be a real asset. This talk will recount first-hand experiences talking to a range of news outlets from the PBS New Hour to Real Simple Magazine about everything from quick-freezing water to pumpkin boats. It will include helpful information about preparing for an interview, learning new physics fast, timelines and follow-up.

10:48AM F38.00015 Talking to Journalists about Your Research. JAMES RIORDON, American Physical Society — Many physicists have the opportunity to speak to members of the media from time to time. A journalist may want to ask about your work, or they may be in search of expert comments on the work of others in your field. I will offer some thoughts on ways to prepare for various types of interviews. I will also suggest some things you should always try to bring up in an interview, and others that you might want to avoid entirely. Finally, I will talk about what you can do when a reporter gets it wrong.

Tuesday, March 19, 2013 11:15AM - 2:15PM –

Session G9 F6: Invited Session: Broadening Participation in Physics and Other STEM Fields
308 - Paul Cottle, Florida State University
will draw from my own research studies in this area. The findings from my study and others reveal that only women who participate in redefinition strategies
current literature on issues affecting undergraduate women's retention in STEM as well as present strategies to improve this retention. Part of this presentation
fields, which could, in turn, improve the nation's economy, safety, and technological revenues. Research indicates that there are internal and external factors
underrepresentation of women and increasing their persistence in STEM fields will increase the number of scientists and engineers contributing to these
economic and environmental security (Augustine, 2005; Chang, 2009; Riegle-Crumb and King, 2010; Robelen, 2010; Tessler, 2008), paying practitioners well
United States' ability to maintain its technological and economic dominance in the global economy. STEM fields provide valuable contributions to the nation's
than a third of undergraduate degrees in science and engineering (STEM). This underrepresentation is worse in certain fields such as physics (21%), and
High Magnetic Field Laboratory — In 2010 women represented half of the US population and over half of current graduates from college (57%) but less
women who earn bachelors’ degrees in physics (22%) compared to 52% in chemistry. This underrepresentation is not only a social and cultural issue, but it is also cause for alarm in regard to the
women in physics since, although girls make up about half of high school physics classes, the fraction of bachelor’s degrees earned by women has been flat at
PhDs, be hired to faculty positions, and achieve promotions at the same rate as their male counterparts. However, such gains do not foretell equal participation
shows a landscape that is somewhat different from our expectations in the past. For example, women who earn bachelor’s degrees in physics can go on to earn
'Innovations Towards Institutional Change.' Particular attention will be paid to the concept of cultural capital, the role of innovators and the challenge of scaling small-scale
innovations towards institutional change.

11:51 AM G9.00002 APS Initiatives for Broadening Participation . THEODORE HODAPP, American Physical Society — Women currently earn only about 20% of physics degrees, while African Americans and Hispanic Americans combined — representing 34% of the US population in their 20s — earn only 0.6% and 5-6% of our bachelor and doctorate degrees respectively. To address these disparities, and improve conditions for
everyone who studies physics, the APS devotes significant resources to addressing these concerns and to enabling individuals and groups to work with the APS to
advance these goals. In this presentation, I will outline several of our most significant programs, give data that informs decisions to adopt programs, and describe
current plans. Included in this is the new APS Bridge Program (www.APSSBridgeProgram.org) for increasing underrepresented minority participation at the PhD
level, the APS Conferences for Undergraduate Women in Physics (go.ap.org/cuwip), and the APS Minority Scholars Program (www.MinoritiesInPhysics.org). I will briefly bring your ideas and concerns for how we might improve participation for all.

12:27PM G9.00003 Drawing minority students into the physics community . PAUL GUEYE, Hampton University/National Society of Black Physicists — In the past few years, the number of African-American undergraduate physics students in the US had a steady decrease with dramatic consequences at many physics departments within Historically Black Colleges and Universities (HBCUs). A similar trend seems to also appear at the graduate level. HBCUs have been known to graduate more than 50% of undergraduate physics majors within this community for many years, a role that is now evaporating. The US African-American community cannot lose the historical and sometimes unnoticed impact of HBCUs in the physics community. The ability for these institutions to recruit, retain, and graduate students with the highest degree has turned a corner and is endangered with the recent closings of many programs. We not only must reverse this trend but also implement a sustainable growth for the future. This is an enormous task for the education community. While there are many outstanding and successful programs that have been developed over the years to target particular areas ranging from early K-12 exposure to producing MS and PhD students, each community/culture is different: one cannot transport someone else's experience and/or program and infuse it into another community. Moreover, the focus must now be comprehensive and not anymore single-centered. This talk will outline some ongoing efforts within the National Society of Black Physicists aimed at using a global approach to this problem that targets school districts (K-12) and after school programs, undergraduate and graduate programs within HBCUs, and the larger physic and scientific community.

1:03PM G9.00004 Drawing Women In: Engaging in Science and Engineering Disciplines . SENTA GREENE, Vanderbilt University — Recent data on the participation of women in the scientific, technological, engineering, and mathematical (STEM) disciplines shows a landscape that is somewhat different from our expectations in the past. For example, women who earn bachelor’s degrees in physics can go on to earn
PhDs, be hired to faculty positions, and achieve promotions at the same rate as their male counterparts. However, such gains do not foretell equal participation
of women in physics since, although girls make up about half of high school physics classes, the fraction of bachelor’s degrees earned by women has been flat at
around 20% for about a decade. This remains true even with significantly increased awareness of the need to attract more women to STEM fields and despite various interventions to attract and retain talented women. This talk will present an overview of data on women's participation in STEM disciplines, provide possible explanations for the continued difficulties to attract women to some STEM fields, and give a brief description of some current interventions.

1:39PM G9.00005 How Undergraduate Women Choose STEM Careers . ROXANNE HUGHES, National High Magnetic Field Laboratory — In 2010 women represented half of the US population and over half of current graduates from college (57%) but less than a third of undergraduate degrees in science and engineering (STEM). This underrepresentation is worse in certain fields such as physics (21%), and engineering (22%) compared to 52% in chemistry. This underrepresentation is not only a social and cultural issue, but it is also cause for alarm in regard to the United States’ ability to maintain its technological and economic dominance in the global economy. STEM fields provide valuable contributions to the nation's economic and environmental security (Augustine, 2005; Chang, 2009; Riegle-Crumb and King, 2010; Robelen, 2010; Tessler, 2008), paying practitioners well and bringing in revenue for successful businesses and governments (National Science Board [NSB], 2008; Riegle-Crumb and King). Consequently, addressing the underrepresentation of women and increasing their persistence in STEM fields will increase the number of scientists and engineers contributing to these fields, which could, in turn, improve the nation’s economy, safety, and technological revenues. Research indicates that there are internal and external factors that affect the ability of women to see future success in STEM and to identify with the STEM and consequently persist. This presentation will summarize the current literature on issues affecting undergraduate women's retention in STEM as well as present strategies to improve this retention. Part of this presentation will draw from my own research studies in this area. The findings from my study and others reveal that only women who participate in redefinition strategies related to their marginalized status are able to persist; those who cannot redefine their marginality in relation to the dominant discourse of STEM begin to lose interest or doubt their competence in the field, resulting in their departure from STEM.
1:03PM N11.00005 Disciplined Based Educational Research – What is it? What has it done? Where is it going? . KENNETH HELLER, School of Physics & Astronomy, University of Minnesota — The National Research Council of the National Academies of Science has just released its study of Disciplined Based Educational Research (DBER) funded by the National Science Foundation. This two year study attempted to define the emerging field of DBER and investigated its state in the fields of Astronomy, Biology, Chemistry, Engineering, Geosciences, and Physics. This talk will give a brief review of the report, discuss the recommendations, implications for future research, and impact of DBER in improving science and engineering instruction at the undergraduate level.


11:15AM Z3.00001 Cottrell Scholars Collaborative – Integrating Research and Teaching . JAIRO SINOVA, Texas A&M University — Higher education reform needs to move towards a more interactive and integrated model, in which there is greater curricular emphasis in skill development, multi-discipline integration, and innovative connectivity, rather than traditional content driven curricula. This is even more crucial in STEM education, given our current slow down relative to other countries and the need to remain competitive in a global environment. Successful reforms require a seamless integration of research and teaching where education excellence and research excellence are not viewed by faculty as a zero sum game but as mutually benefitting ingredients of academic success. Cottrell scholars are selected among top ranking young academics with an equal passionate commitment to research excellence and education. Recently, these national group of academics sponsored by the Research Corporation for Science Advancement have created the Cottrell Scholars Collaborative (CSC) which aims at creating a self-supporting group that promotes integration of research and teaching at a national level with different initiatives. I will describe in these talk the aim of this group and the different sponsored projects that CSC is undertaking and the types of collective and individual efforts that are making a difference in sustainable education reform.


12:27PM N11.00003 The NRC Study of Undergraduate Physics Education: The role, status and outlook for physics education research . PAULA HERON, University of Washington — The Board on Physics and Astronomy of the National Academies formed the “Committee on Undergraduate Physics Education, Research and Implementation” in 2011 and charged it with producing a report that “identifies the goals and challenges facing undergraduate physics education and identifies how best practices for undergraduate physics education can be implemented on a widespread and sustained basis.” (Further information on the committee and its charge can be found at: http://sites.nationalacademies.org/BPA/BPA_059078.) The report is expected to be released in early 2013. This talk will address the committee’s process, some of the findings, and their implications for physics education. The role of physics education research in driving innovation will be emphasized.

1:39PM N11.00006 Disciplined Based Educational Research – What is it? What has it done? Where is it going? . KENNETH HELLER, School of Physics & Astronomy, University of Minnesota — The National Research Council of the National Academies of Science has just released its study of Disciplined Based Educational Research (DBER) funded by the National Science Foundation. This two year study attempted to define the emerging field of DBER and investigated its state in the fields of Astronomy, Biology, Chemistry, Engineering, Geosciences, and Physics. This talk will give a brief review of the report, discuss the recommendations, implications for future research, and impact of DBER in improving science and engineering instruction at the undergraduate level.

11:15AM Z3.00002 Optics for Biophysics: An Interdisciplinary course in Optics for Physicists and Life Science Students . JENNIFER ROSS, University of Massachusetts Amherst — Optics is an applied sub-field of physics that life science researchers utilize daily. Indeed, one cannot open a biological science research journal without seeing five beautiful images of cells. To bridge the gap and educate more life science students in the field of physics, I have developed a new course called “Optics for Biophysics,” an interdisciplinary course engaging students from physics, chemistry, life science, and engineering. The course is a team-based learning or studio physics approach combined with a semester-long project. Mini-lectures of 20 minutes are given before students do hands-on group work to understand the concepts. In the project, the students design and build a modern transmitted light microscope. The final aspect of the project is to build a unique module onto the microscope to address a specific biological question.
12:27PM Z3.00003 Stimulating Creativity by Integrating Research and Teaching Across the Academic Disciplines. RICHARD TAYLOR, University of Oregon — Creativity is a human adventure fueled by the process of exploration. But how do we explore our intellectual interests? In this talk, I’ll propose that we seek out our creative opportunities using an inherent natural process. This process might, therefore, exploit search strategies found across diverse natural systems – ranging from the way animals forage for food to the way the human eye locates information embedded within complex patterns. The symbolic significance of this hypothesis lies in its call for educational institutes to provide environments that encourage our natural explorations rather those that stamp restrictive, artificial ‘order’ on the process. To make my case, I’ll review some of my own research trajectories followed during my RCSA Cottrell Scholarship at the University of Oregon (UO). My first conclusion will be that it is fundamentally unnatural to declare divides across disciplines. In particular, the infamous ‘art-science divide’ is not a consequence of our natural creative searches but instead arises from our practical inability to accommodate the rapid drive toward academic specialization. Secondly, divides between research and teaching activities are equally unnatural – both endeavors are driven by the same creative strategy and are intertwined within the same natural process. This applies equally to the experiences of professors and students. I will end with specific success stories at the UO. These include a NSF IGERT project (focused on accelerating students’ transitions from classroom to research experiences) and a collaboration between architects and professors to design a building (the recently opened Lewis Integrative Science Building) that encourages daily encounters between students and professors across research disciplines.

1:03PM Z3.00004 Integrated Concentration in Science (iCons): Undergraduate Education Through Interdisciplinary, Team-Based, Real-World Problem Solving1. MARK TUOMINEN, University of Massachusetts Amherst — Attitude, Skills, Knowledge (ASK) – In this order, these are fundamental characteristics of scientific innovators. Through first-hand practice in using science to unpack and solve complex real-world problems, students can become self-motivated scientific leaders. This presentation describes the pedagogy of a recently developed interdisciplinary undergraduate science education program at the University of Massachusetts Amherst focused on addressing global challenges with scientific solutions. Integrated Concentration in Science (iCons) is an overarching concentration program that supplements the curricula provided within each student’s chosen major. iCons is a platform for students to perform student-led research in interdisciplinary collaborative teams. With a schedule of one course per year over four years, the cohort of students move through case studies, analysis of real-world problems, development of potential solutions, integrative communication, laboratory practice, and capstone research projects. In this presentation, a track emphasizing renewable energy science is used to illustrate the iCons pedagogical methods. This includes discussion of a third-year laboratory course in renewable energy that is educationally scaffolded: beginning with a boot camp in laboratory techniques and culminating with student-designed research projects. Among other objectives, this course emphasizes the practice of using reflection and redesign, as a means of generating better solutions and embedding learning for the long term.

1This work is supported in part by NSF grant DUE-1140805.

1:39PM Z3.00005 Living the good life: pursuing excellence as a scientist and as a teacher1. ERICA CARLSON, Dept. of Physics, Purdue University — Do research and teaching represent competing demands on our time and energy, or have we bought into a false dichotomy? As a scientist, my job is to find truth. As a teacher, my job is to teach the next generation how to find truth. In this talk, I discuss the ways in which research and teaching have been synergistic in my experience, as well as the tension commonly felt among professors (myself included) as to how to “split our time” between the two. I will share a brief synopsis of my teaching philosophy, and I hope to give some insight into what (in my opinion) makes or breaks you as a teacher. I will also share some of my experience in this great adventure we call scientific progress.

1Support is gratefully acknowledged from Research Corporation for Science Advancement and NSF DMR DMR 11-06187.