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GUEST EDITORIAL *Quality & Quantity: Participation of Women and Minorities in Physics*

By Saeqa Dil Vrtilek, Harvard-Smithsonian Center for Astrophysics, Member of CSWP



Saeqa Dil Vrtilek

Yvonne was one of the thousands who work a job in New York while pursuing a career in music or the arts, but she is one of the rare few who made it. She had her Carnegie Hall debut while I was still a graduate student, went to Germany with a Phillip Glass opera, and there she has been ever since (I found her a few years ago on the web as the title role in Aida). I have no doubt the same strength that led her to fulfill her dream helped me to fulfill mine. It is not that my department

On January 2nd, one of my mainstays during graduate school will visit from Berlin. When I was a graduate student, Yvonne, the department administrative assistant, was the only other woman around: there were no other female graduate students, no female post-docs, and no female faculty.

was unfriendly or deliberately put obstacles in my way, but it is hard to be the only one of one's kind in any environment. And I had more than gender to separate me: I was small, I had dark skin, I was a foreigner, I spoke with an accent, I was older and already married, I had an impossible name, and a not entirely amenable personality. When I emerged in 1985 with my PhD and a US citizenship I was on top of the world. Although I regularly descend to the depths, I always come right back up: Yvonne and I "made it" but not everyone does. I would wish support such as I received from Yvonne for every minority, but barring that possibility, I believe it is numbers that matter.

At my undergraduate institution, the percent of female physics majors has gone from 2% when I was there to 25% in 2006. This is tremendous progress. When the ratio of female to male undergraduates reaches 50%, we will have achieved numerical parity for one issue in at least one institution. And it can be done: if an increase by a factor of 12 can happen in 32 years, surely an increase by a factor of two will not

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Women of Color in Physics Departments: A Data Snapshot

By Rachel Ivie, Statistical Research Center, American Institute of Physics

Most readers know that there are very few women of color in physics, and it is important to know exactly how few there are. However, the numbers alone do not adequately portray the day-to-day inequality that women of color experience in physics. In my years of studying women in physics, I have seen many people make the mistake of assuming that if the representation of women in physics increases to some "acceptable" level, then the problem of inequality will be solved. This is far from the truth. While it is essential to document and remedy the small numbers of women of color in physics, it is also necessary to collect data on other areas of inequality so that they can be addressed. To my knowledge, a few researchers have begun to collect these data (Maria Ong, TERC, and Sharon Fries-Britt, University of Maryland, for example), but the results

are either not yet available or have not been widely disseminated among the physics community. This article will document the tiny numbers of women of color in physics and will also point to areas of potential inequality about which we have no data. These include hiring, salaries, promotions, working conditions, and the general experiences of women of color in physics.

Representation. Figure 1 (bachelor's degrees), Table 1 (PhDs), and Table 2 (faculty members) show just how small the numbers of women of color in physics are. At the beginning of the academic pipeline, there is only a trickle of women of color into physics, and the numbers don't improve farther along. For comparison, approximately 5000 people, mostly white male

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APS Launches New Minority Bridge Program

By Gabe Popkin, APS Education Program Manager

The APS recently launched a program to increase the number of under-represented minority (URM) physics doctoral recipients in the US. The new Minority Bridge Program (MBP) will facilitate the transition of minority physics majors to graduate programs in physics via bridge programs between institutions where these students earn their bachelor's degrees and PhD-granting research institutions.

Currently, URM (defined for this purpose as including African-Americans, Hispanic-Americans, and Native-Americans) make up a third of the country's college-age population and around ten percent of the undergraduate physics majors in the country, but receive only five to six percent of the physics PhDs, according to data from the US Department of Education. "Minorities are under-represented in physics at all steps along the education pathway," says Theodore Hodapp, Director of Education and Diversity at APS. "We have chosen to address the gap between bachelor's and PhD recipients because this is where we can have the greatest impact." MBP project leaders hope to close this gap through a multi-pronged approach that includes the identification of students with an interest in pursuing graduate degrees in physics, career guidance, development of appropriate undergraduate research opportunities, financial support, and mentoring.

"While several programs exist to increase the number of science, technology, engineering, and math (STEM) undergraduates going on to PhD programs, they tend to have limited success in physics," says Michelle Iacoletti, who manages the MBP for APS. "The challenge unique to physics is one of applicability. Most minority students aren't aware of the careers they can pursue with a physics degree, and lack role models with careers in science. Therefore, career awareness is a big focus of our program."

Faculty at minority-serving institutions confirm that their students tend toward fields with high-visibility career pathways, such as medicine and engineering. "The student population we serve at the University of Texas at San Antonio is primarily first-generation, making engineering programs a popular choice. What we find, however, is that a lot of our engineering students are actually more interested in physics," says Lorenzo Brancaleon, a physics professor at UTSA.

In the first phase of the project, APS staff are visiting institutions that educate a significant number of minorities to talk to undergraduates and faculty members and identify their needs. "Personal contact with URM students is crucial in remediating the lack of awareness of physics careers. We won't succeed by just mailing a brochure," Hodapp maintains.

Project leaders are also assessing the commitment levels and resources available at a number of research institutions. A conference bringing together students and faculty from minority-serving institutions, faculty and administrators from research institutions, and representatives of successful existing bridge programs is planned for June 2010. The outcome will be a set of operational plans for successful bridge programs specifically tailored to physics undergraduates. Funding for the current efforts comes from the National Science Foundation.

"The under-representation of minorities in physics graduate programs is especially troubling because it leads to a shortage of minority faculty who can serve as mentors to minority students," says APS President Cherry Murray, who chairs the MBP's steering committee. "We hope our efforts will ultimately lead to benefits for students at all educational levels."

For more information, visit www.aps.org/mbp. ■



Michelle Iacoletti, Project Manager for the APS Minority Bridge Program (dark suit, center) with physics students at the Mayagüez campus of the University of Puerto Rico.

Women of Color in Physics Departments, *continued from page 1*

US citizens, earn bachelor's degrees in physics annually. In 2007, only 181 women of color (including Asian American women) earned bachelor's degrees in physics. In the 33 years shown on Table 1, more than 35,000 people have earned physics PhDs in the US, but only 111 under-represented minority women have done so. In all 800 physics and astronomy departments in the US (Table 2), there are approximately 9100 full-time equivalent faculty positions, but there are only 29 black women and 38 Latinas on physics faculties.

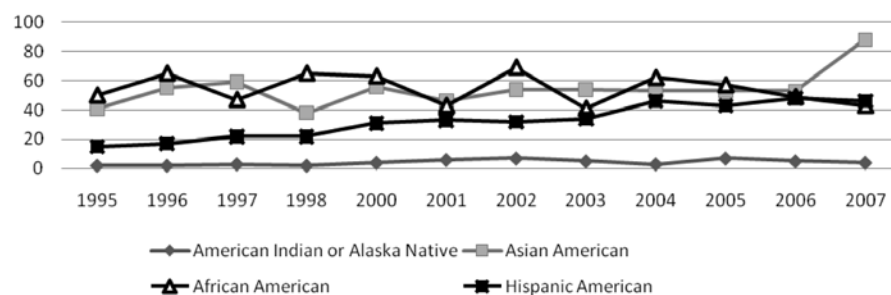
URM women. The category "under-represented minority" (URM) applies to minority groups that are represented in science at rates lower than their representation in the US population. Therefore, African Americans, Hispanic Americans, and American Indians are considered URMs in science and in physics. Table 1 reveals just how low the numbers of URM women are. These data represent the numbers of physics PhDs earned by women in a 33-year period. African American women average a little more than one physics PhD per year. Hispanic women average fewer than 2. And the smallest number of all is American Indian women: there have been only four physics PhDs earned by American Indian or Alaskan Native women since 1974.

Asian American Women. The statistics on the representation of Asian American women in physics help illustrate why additional data on the experiences of women of color are needed. Compared to their proportion in the US population (about 5%), Asian Americans are not under-represented in science generally or in physics specifically. Asian American women are more than adequately represented in physics, but they may be just as likely to face discrimination in the workplace as other women of color.

Representation doesn't tell the whole story. Women of color in physics are "double minorities:" minorities because of race and sex. For all minorities, representation does not tell the whole story, although it certainly plays a large part. As double minorities, women of color may be subject to inequities in hiring, salary, promotions, etc. Their experiences are likely to be different from men's and from white women's experiences. But data on these topics generally have not been collected. Data are missing about the experiences of women of color in physics, along with quantitative data on hiring, salary, and promotions. However, women of color are likely to experience inequity in most, if not all, of these areas. Furthermore, we don't know if the problems are happening in the higher education system, in the workplace, in both, or if the reasons for low representation happen much earlier in the pipeline.

Conclusion. Sometimes scientists think that their work environments and classrooms are not affected by issues of race or sex. By studying the actual experiences of women of color in physics, we can determine whether or not this is true. These data also have important implications for efforts to recruit and retain women of

FIGURE 1 NUMBER OF WOMEN OF COLOR EARNING BACHELOR'S DEGREES IN PHYSICS IN THE US, 1995-2007



SOURCE: NATIONAL CENTER FOR EDUCATION STATISTICS. DATA NOT AVAILABLE FOR 1999.

color in physics. Because of the lack of data on where the problems lie, such efforts may be ineffective if they are directed to situations that do not need correction. Programs to increase the representation women of color in science should be based on data documenting the exact nature of the problems, rather than on assumptions about these problems. These data can only be gathered by studying women physicists of color at a more detailed level, perhaps using in-depth interviews and collecting data on facts other than representation.

Correcting the low representation of URM women in physics will go a long way toward ending the inequities they experience. However, this will not remedy all problematic areas. It will not address discrimination that all women of color may experience in their daily lives as physicists. Inequities such as these, if they exist, should be documented so that corrective steps can be taken by institutions. At that point, we will truly have made progress toward an equitable situation for women of color in physics. ■

Thanks to Arnell Ephraim of the Statistical Research Center, American Institute of Physics, and Kenneth Nunn for their assistance with this article.

TABLE 1 NUMBER OF WOMEN WHO HAVE EARNED PHDS IN PHYSICS IN THE US, 1974-2006

	NUMBER	%
US Citizens and Permanent Residents		
African American	46	1.2
American Indian or Alaska Native	4	0.1
Asian American	492	12.8
Hispanic	61	1.6
White	1784	46.3
Temporary Residents	1466	38.0
Total	3853	100

SOURCE: NATIONAL SCIENCE FOUNDATION

TABLE 2 NUMBER OF WOMEN FACULTY IN US PHYSICS & ASTRONOMY DEPARTMENTS, 2008

	PHD	MASTERS	BA	TOTAL	% OF ALL WOMEN
African American	14	3	12	29	3
Asian American	106	14	56	176	16
Hispanic	19	7	12	38	3
White	465	64	340	869	78
Total				1112	100

SOURCE: AIP ACADEMIC WORKFORCE SURVEY

African American Women: Still Many “Firsts” in Physics

By K. Renee Horton, University of Alabama

If someone asked, “Who is Willie Hobbs Moore?”, most people would answer that she was the first African American woman to earn a PhD in Physics from the University of Michigan in 1972. Did you know she was also the first African American woman to graduate in engineering from the University of Michigan? The unfortunate moral of this story is that the first PhD in Physics earned by a minority woman at the University of Michigan came more than 54 years after the first African American male earned one in 1918.

If someone asked, “Who is Apriel Hodari, Elaine Lalanne, Jami Valentine or Martha-Elizabeth Baylor,” what would you guess? Would you guess that each of these African American women were the first to earn PhD’s in Physics from their respective universities more than 20 years after Dr. Willie Hobbs Moore? While it seems unreal, each of their stories is unique. Not only was Dr. Apriel Hodari the first African American woman to receive her PhD in Physics from Hampton University in 1998, she was part of the first class of physics PhD students to graduate from Hampton University. “It seemed natural that I’d be in the first class to finish,” she noted. The class was comprised of about 30 graduate students who were 90-95% African American and 50% female. Hampton University is now one of the leading producers of African American PhD’s in Physics, thanks to Dr. Hodari and other trailblazers who have opened doors for others to follow. She currently works for the Center for Naval Analyses, serves on the Executive Board for the National Society of Black Physicists, and is a member of the Committee on the Status of Women in Physics.

Dr. Elaine Lalanne is a Research Associate at the Center for Advanced Studies in Photonics Research, University of Maryland, Baltimore County. Dr. Lalanne was the first African American female to earn a PhD in Physics in 2003 from the New Jersey Institute of Technology (NJIT)/Rutgers-Newark and, in her humility, modestly omits the fact that she was the only African American woman in the United States to receive a PhD in Physics that year. When asked what it feels like to be the “first,” Dr. Lalanne responds, “[I felt] isolated and did not have support with respect to studying until the African students arrived two years later into the programs. Having an African American advisor, [Dr.] Anthony Johnson [then Chair of the NJIT Physics Department], was instrumental in my success in making it through the program.”

Dr. Jami Valentine, who graduated from John Hopkins University (JHU) in 2007, made history as the first African American woman to receive a PhD in Physics from JHU and the second African American ever in physics, with the first receiving his doctorate from this distinguished university in the 1970’s. When she

thinks of being a “first,” she says she is, “very proud to be the first African American woman from Hopkins (and the second in the state of MD). It’s still amazing to me that in a city more than 65% African American (Baltimore), there’s still such a small percentage of African American students at JHU. [Based on my experience], I feel that I’m able to relate to the students that I meet through various mentoring/outreach programs in a more meaningful way.” Before graduating in 2007, Dr. Valentine was a member of the U.S. Delegation to the International Pure and Applied Physics Women in Physics Conference in Rio de Janeiro, Brazil, and she is profiled in the book, *Cool Careers in Physics* by John Johnson, Jr. She is currently employed at the United States Patent and Trademark office.

Dr. Marty Elizabeth Baylor, or “Marty” to some, graduated in December 2007 with a PhD in Physics from the University of Colorado, which, prior to her tenure, only had one other minority student, a Hispanic male. She recalls a handful of women but definitely no other African Americans. Dr. Baylor says, “In fact, I was the first Black women in the state of Colorado to obtain a PhD in physics and probably the first or second African American at the University of Colorado to get a PhD in Physics.” When asked how she felt about being the only African American, Dr. Baylor says, “being the only African American in the program didn’t bother me. I was just myself and did what I needed to do to succeed... I do think that being a first generation PhD in science caused me to start at a disadvantage and that at times I probably received some poor mentoring. However, I don’t think that was because I was African American. I think it is because some people are better mentors than others.” Dr. Baylor is currently a Post-doctoral Fellow in the Department of Electrical and Computer Engineering at the University of Colorado.

Each of these women is amazing in their own right. What is more amazing is that they aren’t the only ones who are “first.” There are others who don’t want recognition and would prefer not to be mentioned or associated with the title of “first African American” anything. As for me, I am proud that I will be the first African American, as well as the first in my family, to earn a Material Science/Physics PhD from the University of Alabama in December 2010. I am disappointed that there still are no other African Americans in the program and, unfortunately, I may be the only one for some time to come.

Nevertheless, this does show that there is change no matter how long it takes and that with change is the hope that one day the only “firsts” we will be highlighting in Physics will be the discoveries made in laboratories. ■

Gender Equity Conversations Project Plans to Engage Historically Black Colleges and Universities

By J.C. Holbrook, University of Arizona and Sherry Yennello, Texas A&M University

Since 1990 the Committee on the Status of Women in Physics (CSWP) has been conducting site visits to university physics departments and to national laboratories to help improve the climate for women in these settings. After visits to 40 colleges and universities and 8 research facilities, CSWP has compiled descriptions of best practices gleaned from these visits into a document that is freely available at www.aps.org/programs/women/reports/bestpractices/index.cfm.

In May 2007, CSWP held a workshop on Gender Equity that included the chairs of 50 top physics departments and unit leaders from 14 national laboratories. This highly successful workshop was the first stage in the overall effort to instigate institutional transformation in the field of physics by creating change agents, i.e. individuals and groups of individuals that have the skills and desire to create institutional change. The newest effort of the committee is a set of conversations on gender equity being held in universities around the country, and led by leaders from the Gender Equity workshop (www.aps.org/programs/women/workshops/gender-equity/sitevisits/index.cfm.)

The goal of the new program is to facilitate discussions about how to create physics departments with climates in which women physicists at all career stages feel welcomed, valued, and supported as well as promoted up through the ranks and included in the pool of leadership positions. The facilitators bring extensive knowledge of gender equity literature and collected “best practices”, to help the members of the host department develop successful strategies for their particular local circumstances. The “conversations” are in the form of a one-day visit by three or more facilitators. Each visit begins with a group session that includes as many members of the physics department as possible representing all ranks and students, and introduces everyone to the project and presents the agenda. The rest of the day is broken into meetings with each group: undergraduates, graduate students and postdocs, faculty, and staff. The final session is with faculty members and the department head. At the end of the day, the department creates a list of action items with estimated dates for completion.

Since the goal was to double the number of female faculty, the departments that were selected for the initial workshop were those with large PhD programs. Few Historically Black Colleges and Universities (HBCU) have large PhD programs but as a group they have a better track record for graduating women in physics at the undergraduate level (37% at HBCUs vs. 21% for all schools in the period 2004-2006¹). The success of minority women in physics is important to the overall goal of doubling the number for women in faculty positions and to utilizing a talent pool that has been largely untapped. Uncovering the experiences of departments in minority serving institutes and more broadly experiences of minority women in physics is important.

In order to explore the best practices employed by HBCUs, a special session is being planned at the joint annual meeting of the National Society of Black Physicists and the National Society of Hispanic Physicists.² The session is designed to be a two and a half hour exercise to introduce the gender equity conversation project to and gather information from those in attendance. The goals for the session include: 1) Interacting with people from HBCUs to learn what they have done to create a relatively women-friendly environment. 2) Interacting with minority women to learn what they consider to be women friendly practices and how they have learned to survive within hostile and discriminatory environments. Finally, this session cannot substitute for CSWP site visits and gender equity conversation visits, thus another goal is 3) to make HBCUs and other minority serving institutions aware of these CSWP programs so that they can be included in the next round of activities. ■

Endnotes

¹ Department of Education IPEDS survey.

² As the Gazette goes to press, the 2010 NSBP/NSHP Conference has been reduced to a one-day only meeting on Saturday, February 13 from 8:30 am to 5:30 pm at the OMNI Shoreham Hotel due to funding restrictions. Details of the schedule of events will be posted on the NSBP website at www.nsbp.org/conference/. Please check there frequently.

Are you looking for a graduate school that is “female friendly”?

Check out the results of an informal survey and read what departments say about themselves at:

www.aps.org/programs/women/female-friendly/index.cfm

Alessandra Lanzara is 2010 MGM Award Winner



Alessandra Lanzara

Citation: “For high-resolution angle-resolved photoemission spectroscopy and imaging studies of the cuprate superconductors and graphene that elucidate their electronic properties”

Alessandra Lanzara received her Ph.D. in Physics from University of Rome La “Sapienza” in 1999, and her Laurea (equivalent to M.S.) from the same University in 1995. In 2002 she joined the Physics Department of the University of California, Berkeley as an Assistant Professor and became Associate Professor in 2006. She has also a joint Faculty appointment in the Materials Sciences Division of the Lawrence Berkeley National Laboratory.

Her main research interests lie on the frontier aspects of condensed matter physics, motivated by the search for new states of matter with main focus on high temperature superconductivity and Dirac materials. Her main contributions to these fields are: The discovery of a universal energy scale in cuprates superconductors, that might hide the secret for superconductivity; and the discovery of a new way of band gap engineering of graphene through graphene/substrate interaction, a fundamental step toward graphene electronics. She is also pushing the frontier of photoemission spectroscopy to the time and spin realm, with the development of a novel concept of electron analyzer for spin detection.

Because of this she has been awarded the W. McMillan Award (2003) and the Shirley Award (2007) and was elected Fellow of the American Physical Society (2008). Other prestigious awards are: Career Award, National Science Foundation (2003-2008); Sloan Research Fellow (2004) and Distinguished Women in Physics Lecture (2007).

Dr. Lanzara is author of more than 100 papers in refereed journals and co-inventor of three patent disclosures. Three of her papers have been identified by the citation tracking algorithm of the Institute for Scientific Information as among the most cited recent papers in its periodic surveys.

She is member of the American Chemical Society by invitation (since 2006) and of the American Physical Society (since 2001).

The Maria Goeppert Mayer Award recognizes outstanding achievement by a woman physicist in the early years of her career and provides opportunities for her to present these achievements to others through public lectures in the spirit of Maria Goeppert Mayer. The award consists of \$2,500 plus a \$4,000 travel allowance to provide opportunities for the recipient to give lectures in her field of physics at four institutions and at the meeting of the Society at which the award is bestowed and a certificate citing the contributions made by the recipient. ■

ASK THE PHYSICS MENTOR

Lidija Sekaric, US Department of Energy, Chair of CSWP, is this issue's Physics Mentor.

I am a second-year PhD Physics student but I am still struggling with finding a balance between interesting research and finding an advisor and group that I can fully get along with and where I feel supported. I have been hoping for a PhD advisor who is more of a mentor, taking an active interest in teaching me, rather than just a boss who gives me a project and the resources I need and then leaves me to my own devices. It is also discouraging seeing and hearing of so many labs where 15-hour days are the norm, most of the group is in every weekend, etc. Where do I find the sort of people in the department I should be talking to, and what questions I should be asking them?

Answer: It may or may not be good news to hear that what you are experiencing seems to be fairly typical for a graduate student. Knowing that you are not alone in the quest for finding a perfect group and a perfect advisor may help you reach out to your classmates first and see if they have developed any strategies for addressing this issue. When interviewing prospective advisors you should explicitly raise the issue of mentoring and how it is addressed in the group. On the other hand, mentors exist in most surprising places. I would recommend informally interviewing senior graduate students and post-docs whom you (or others) consider successful and asking them what it took for them to succeed. The routes to getting the right advice and support are not obvious and

those venues do change going from the undergraduate environment, for example, to becoming an independent research professional. Not one of us has succeeded by thinking and creating in a vacuum of ideas and people. Reaching out to the community and brainstorming is a part of the job.

Addressing the long hours in the lab, which may be or may not be about a more balanced life and activities, is an exercise in developing personal efficiency strategies which will serve you long after getting your PhD. Efficiency may not be a priority for an average graduate student with rare pressing deadlines; and while you are undertaking your first major research projects you have to try things out in more inefficient ways. But ultimately, if

you are feeling stuck you should reach out (see above!). If there is something there to keep you in the lab, you will likely want to be in the lab. If not, you should go to your band practice, or go for a run. Your best ideas may materialize outside the lab. You should not feel guilty about doing that which enables your success and personal satisfaction. ■

Do you have a question for the Physics Mentor? Send it to women@aps.org. A member of the Committee on the Status of Women in Physics will offer suggestions in the next issue of the Gazette. No name, institution, or any identifying features will be attached to your question and all questions will be held in confidence. We invite our readers to weigh in on this and other career related questions.

Katherine Freese Elected to Fellowship

By Mike Lucibella, APS Staff Writer

Katherine Freese was awarded an APS Fellowship for her years of exceptional work in physics. She was cited for her “pioneering work on the theories of inflation, dark matter and dark energy,” as well as her efforts to promote physics as a field, and women within the field. She is currently the George E. Uhlenbeck Collegiate Professor of Physics at the University of Michigan and the Associate Director of the Michigan Center for Theoretical Physics.

Freese’s research centers on the study of dark matter and dark energy. Observations of the motion of galaxies show that only around 4 percent of the universe is made up of observable matter. The rest is made up of either the mysterious dark matter, particles that are almost completely undetectable by normal means, or the even more enigmatic dark energy.

Since starting her career, Freese has always been at the cutting edge of dark matter research. She was part of the first team of physicists to run the velocity calculations on these galactic motions. They proved conclusively that this mysterious dark matter couldn’t just be large deposits of difficult-to-see ordinary matter, like giant unlit stars or planets. Instead this dark matter had to be made of exotic new particles, termed WIMPS for Weakly Interacting Massive Particles, that didn’t shine and barely interacted with normal matter.

Building on that work, Freese was a pioneer in the new field exploring the possible dynamics of these WIMPS. She developed theoretical methods to find these seemingly undetectable particles by looking for tell-tale neutrino signals emitted when WIMPS interact with the sun. After first proposing these techniques nearly two decades ago, detectors built to look for these signatures are operating all over the world.

Antarctica’s Ice Cube Neutrino Observatory, as well as the DAMA detector under the Italian Alps, are both looking for a neutrino signal that would indicate the presence of a dark matter particle. The Enriched Xenon Observatory being built outside of Carlsbad, New Mexico is likewise joining in the hunt. Freese is optimistic that these detectors and others will soon conclusively prove the existence of WIMPS. “There are anomalous signals all over the place,” she said.

Not one to rest idly on her laurels, Freese has continued to push the limits of cosmology. She went on to work on problems modeling the period of inflation in the early universe. The model she developed is the most widely accepted model of the early universe’s inflationary phase, and has closely matched observations of the cosmic microwave background radiation taken by the WMAP satellite.

Her latest work involves theorized “dark stars” formed out of dark matter when the universe was only a few million years old. These proposed stars were gigantic, possibly as big as an entire solar system,

a thousand times more massive than the sun and up to a billion times brighter. However instead of being powered by nuclear fusion, they shone because of self-annihilating dark matter particles. Over time, as the dark matter exhausted itself, these tremendous stellar bodies would collapse down into super massive black holes. Freese thinks that this might be the key to understanding the origins of the super massive black holes that exist at the center of most galaxies. “We’re proposing a new phase of stellar evolution,” Freese said, “A whole new kind of star to look at.”

Freese’s interest in physics was first sparked when she was fifteen and took it as a summer course because her high school didn’t offer it. From there out, she was hooked. “I wanted to know how the world works,” she said, adding that feeling has stuck with her and now she is “trying to understand how the universe works.”

She went on to be the second woman to earn a bachelor’s degree in physics at Princeton. From there she received her master’s at Columbia, and PhD at the University of Chicago. She received post doc fellowships at the Smithsonian Center for Astrophysics, the Kavali Institute for Theoretical Physics at the University of California at Santa Barbara and briefly at the University of California Berkeley. From there she received a professorship at MIT before settling at the University of Michigan as a full time professor.

At the University of Michigan, Freese has made the status of women in physics one of her top priorities. “I’ve been trying to make things happen at my own institution,” Freese said, “Things are definitely improving.” She helped to organize many of the female grad students as a group to meet once a month to discuss issues facing women at the university. One early victory came when they lobbied the university for a lactation room, and within a month, space was set aside for one. In 2002 she helped bring the National Science Foundation’s ADVANCE program to the University of Michigan. The program provides funds to develop techniques to attract more women to careers in the fields of science, technology, engineering and mathematics.

Freese brings this devotion to APS’s Council as well. Now on her second year as one of APS’s general councilors, she said that one of her top priorities is on improving the status of women in the sciences. “I’m a strong believer in trying to increase the role of women in physics,” she said, adding that the financial support of physics research is likewise an issue she has tried to address, “The funding of physics I’m very concerned about.”

As a member of the Astronomy and Astrophysics Advisory, Freese advises the National Science Foundation, NASA and the Department of energy on important science issues including program funding. ■



Katherine Freese

Women Named to Fellowship, Prizes and Awards

By Sue Otwell, APS Staff

Each year, APS members are nominated by their peers to prizes and awards and to fellowship in the society. The nomination and selection procedure, involving APS-appointed selection committees, guarantees their high standards and prestige.

Prizes and Awards

More than forty APS Prizes and Awards recognize outstanding achievements in research, education and public service. This year, nine women are among the recipients.

Marcia C. Barbosa

Universidade Federal do Rio Grande do Sul

Recipient of the Dwight Nicholson Medal (2009)

For her leadership of the first International Conference on Women in Physics, that changed the visibility of women in physics, and her personal commitment to supporting and encouraging women in physics around the world.

Kathryn Greenberg

Mount Holyoke College

Recipient of the LeRoy Apker Award (2009)

Thermal Coupling and Lensing in Arrays of Vertical Cavity Surface Emitting Lasers.

Alessandra Lanzara

University of California, Berkeley

Recipient of the Maria Goeppert Meyer Award

Citation: For high-resolution angle-resolved photo-emission spectroscopy and imaging studies of the cuprate superconductors and graphene that elucidate their electronic properties.

Priscilla Laws

Dickinson College

Recipient of the Excellence in Physics Education Award

For twenty-three years of national and international leadership in the design, testing, validation, and dissemination of research-based introductory physics curricula, computer tools and apparatus that engage students in active learning based on the observation and analysis of real phenomena.

Yueh-Lin (Lynn) Loo

Princeton University

Recipient of the John H. Dillon Medal

For insightful experiments connecting structure with performance in conducting polymers, organic electronics, and functional block copolymers.

Margaret M. Murnane

University of Colorado

Recipient of the Arthur L. Schawlow Prize in Laser Science

For pioneering work in the area of ultra-fast laser science, including development of ultra-fast optical and coherent soft x-ray sources.

Nicola Spaldin

University of California, Santa Barbara

Recipient of the James C. McGroddy Prize

For groundbreaking contributions in theory and experiment that have advanced the understanding and utility of multiferroic oxides.

Patricia Thiel

Iowa State University

Recipient of the David Adler Lectureship Award

For seminal contributions to surface structure and dynamics of complex metallic alloys, including quasicrystals and kinetically limited growth and relaxation of nanostructures in thin metal films.

Anne White

General Atomics

Recipient of the Marshall N. Rosenbluth Outstanding Doctoral Thesis Award (2009)

For the first simultaneous measurements of long-wavelength electron temperature and density fluctuations in the core of a high-performance tokamak plasma, demonstrating larger than expected temperature fluctuations; and for comparison of this data with nonlinear gyrokinetic simulations.

Bilin Zhuang

Wellesley College

Recipient of the LeRoy Apker Award (2009)

Thermodynamics of Ising Systems of the Triangular Kagome Lattice and Small-Model Approximations to Geometrically Frustrated Systems.

Fellowships

New Fellows of APS are elected after careful and competitive review and recommendation by a fellowship committee on the unit level, additional review by the APS Fellowship Committee and final approval by the full APS Council. Only 1/2 of 1% of the total APS membership is selected for Fellowship in the Society each year. Of the more than 220 physicists named to Fellowship in 2009, twenty-three are women.

Cammy Abernathy

University of Florida

For contributions to the development of compound semiconductor materials growth using molecular beam epitaxy.

Nominated by Forum on Industrial & Applied Physics

Reka Albert

Penn State University

For pioneering work in understanding the organization and dynamics of biological networks.

Nominated by Division of Biological Physics

Manuela Campanelli

Rochester Institute of Technology

For groundbreaking work on numerical simulations of binary black hole spacetimes, and for explorations using these simulations of interesting physical effects such as “superkicks” and spin-driven orbital dynamics.

Nominated by Gravitation

Ruth Chabay

North Carolina State University

For contributions to the development of computer-based learning and tutorial systems, visualizations, and curricula that have modernized and improved how students learn physics.

Nominated by Forum on Education

Lynn Cominsky

Sonoma State Univ

For her seminal work to promote student and teacher education using NASA missions as inspiration.

Nominated by Forum on Education

Sarah Eno

University of Maryland

For contributions in particle physics involving electroweak parameters, precision electroweak measurements, and physics beyond the Standard Model at the Tevatron.

Nominated by Division of Particles & Fields

Katherine Freese

University of Michigan

For pioneering work on the theories of inflation, dark matter, and dark energy.

Nominated by Gravitation

Beate Heinemann

University of California Berkeley

For contributions to the search for physics beyond the Standard Model through precision measurements in electron-proton collisions and direct searches for new particles and phenomena in proton-antiproton collisions.

Nominated by Division of Particles & Fields

Kathleen Kash

Case Western Reserve University

In recognition of the breadth of her outstanding contributions to the study of semiconductors, which include the invention and study of strain-induced semiconductor quantum wires and dots, the study of carrier-phonon interactions using optical spectroscopy, and the development of novel synthesis methods for nitride semiconductors

Nominated by Division of Materials Physics

Jueinai Kwo

National Tsing Hua University

For her outstanding work in developing novel electronic materials using innovative fabrication techniques, especially her pioneering work that laid the foundation for the field of artificial magnetic superlattices.

Nominated by Division of Materials Physics

Ka Yee C. Lee

University of Chicago

For her discoveries of new morphologies and molecular behavior in model lipid films of biological and medical importance.

Nominated by Division of Biological Physics

Chung-Pei Ma

Univ of California at Berkeley

For her important contributions to theoretical astrophysics, particularly in the areas of relativistic evolution of density perturbations, constraints on dark matter properties in structure formation models, and the dynamics of galaxy and dark matter halo mergers.

Nominated by Division of Astrophysics

Patricia McBride

Fermilab

For her original contributions to flavor physics at LEP and the Tevatron and to the development of major new initiatives in B-physics and collider physics.

Nominated by Division of Particles & Fields

Gail McLaughlin

North Carolina State University

For her work in elucidating the role of neutrinos in nucleosynthesis in supernovae and black hole accretion disks, and for her studies of the potential of low energy beta-beams in neutrino physics.

Nominated by Division of Nuclear Physics

Fellowships, *continued from page 9*

Teresa Montaruli

University of Wisconsin-Madison

For fundamental contributions, both experimental and theoretical, to the understanding of cosmic and atmospheric neutrino fluxes, neutrino mass, and the spectra of dark matter annihilations

Nominated by Division of Astrophysics

Christine Orme

Lawrence Livermore National Lab

For her outstanding contributions in understanding the fundamental physics of crystallization and materials assembly with application to biomineralization, biomimetic synthesis, and shape control of nanostructures.

Nominated by Division of Materials Physics

Shelley Page

University of Manitoba

For her leading role in a series of sequential hadronic parity violation experiments designed to elucidate the interplay of the weak and strong interactions in hadronic systems.

Nominated by Division of Nuclear Physics

Francoise Remacle

University of Liege

For studies of systems with a high density of states such as Rydberg systems, quantum dot arrays and peptides, and their utilization in molecular information processing and attoscience.

Nominated by Division of Atomic, Molecular & Optical Physics

Gay Stewart

University of Arkansas

For her work preparing teachers at the University of Arkansas, and for her leadership in the Physics Teacher Education Coalition and on the College Board Advanced Placement Physics Test Development Committee and the AP Physics Redesign Commission.

Nominated by Forum on Education

Joka Vandenberg

Alcatel-Lucent/Bell Labs

For the invention of a method to use x-ray crystallography for nano-scale feed-back control of the growth of multi-quantum-well, ternary-semiconductor lasers that then enabled optical communications for worldwide internet, voice and data systems, and for a distinguished career of contributions to understanding the structure of new materials.

Nominated by Forum on Industrial & Applied Physics

Usha Varshney

National Science Foundation

For outstanding leadership and advocacy in advancing and promoting the fundamentals of device physics by formulating innovative and visionary research and education programs in spin and flexible electronics.

Nominated by Forum on Physics & Society

Michelle Wang

Cornell University

For developing novel single molecule techniques in biophysics for measuring protein binding locations on DNA and the torsion of DNA under stress, with applications to the investigation of DNA packing/unpacking and studies of molecular motors which operate on DNA.

Nominated by Division of Biological Physics

Catherine Westfall

Michigan State University

For pioneering historical research on five American national laboratories, and for her organizational work in the history of physics, especially in the productive ongoing series of Laboratory History Conferences.

Nominated by Forum on the History of Physics



RUNNING IN CIRCLES LOOKING FOR A GREAT SCIENCE JOB OR HIRE?

The American Physical Society (APS) Career Center is the best niche employment site for physical science and engineering jobs, with hundreds of jobs viewed by thousands of the finest scientists each month.



<http://careers.aps.org>

- > Research Physicist
- > Department Chair
- > Principal Scientist
- > Postdoctoral Fellowship
- > Plasma/Laser Engineer
- > Optical Physicist
- > Mechanical Engineer
- > Electrical Engineer

The APS Career Center is part of the *Physics Today* Career Network, a niche job board network for the physical sciences and engineering disciplines. Jobs and resumes are shared with four partner job boards – *Physics Today* Jobs and the American Association of Physics Teachers (AAPT), AVS: Science and Technology of Materials, Interfaces, and Processing, and IEEE Computer Society Career Centers.

Quality and Quantity, *continued from page 1*

be that much longer. As for minorities, in the period 2004-2006 the fraction of women physics majors was 37% in Historically Black Colleges and Universities (see article by J.C. Holbrook in this issue) as opposed to an average of 21% for all schools. Are HBCU's doing something for women that majority white institutions are failing to do? Or are there other factors at work? And what can we do so that the terms HBCU and majority white become irrelevant?

From the numbers presented in Rachel Ivie's report (this issue) it appears that once the hurdle of obtaining a PhD is past, the "double minority" status helps African and Hispanic women to secure faculty positions, but hurts Asian women. 63% of African American women and 62% of Hispanic American women who earned PhDs in the past 33 years currently have faculty positions, but only 48% of White American women and a mere 36% of Asian American women who earned PhDs in the past 33 years currently have faculty positions. But, as Ivie points out, we do not know the status of the women who are in these faculty positions: do their salaries and benefits equal those of their white male counterparts? Do their lab and office spaces compare? In 1995 Nancy Hopkins literally took ruler and tape to measure lab space and was able to get MIT's administration to acknowledge gender discrimination against its tenured women professors. What is clear is that the overall numbers are pitifully small, and it is important to get more minority PhDs into the pool.

APS has several programs to increase the number of women and minorities receiving PhDs (see article by Gabe Popkin in this issue); and to improve the quality of their experience at all stages (J.C. Holbrook, this issue). The NSF also has many programs addressing similar issues (e.g., ADVANCE; Historically Black Colleges and Universities Undergraduate Program (HBCU-UP); the now-ended program, Visiting Professorships for Women (VPW); the Pan American Advanced Studies Institutes Program (PASI); and the Presidential Awards for Excellence in Science, Mathematics and Engineering Mentoring (PAESMEM). What I propose here are some very minor changes dealing with the writing and review of proposals since we all "spend staggering amounts of time writing and reviewing other's grants," to quote Nancy Hopkins.

Over the years, the burden of adding a broader impact component to science proposals for NSF has increased. The ultimate insult would be to have a minority woman denied the opportunity to carry out "exciting science with interesting and timely early results" because she is not doing enough to improve the environment for women and minorities. Shouldn't the best science still be the ultimate goal? What if the outreach required that those whose proposals are successful give a talk on their work at an institution or meeting that is outside their normal venue? Successful white male scientists could visit predominantly black institutions or, even better, attend meetings of the societies of those minorities where they can see first-hand

the number of able and available minorities. Minority scientists could give lectures at predominantly white institutions so that the students are exposed to winners of awards who may look nothing like themselves. The cost of one trip per award would be negligible. What is the benefit of seeing the other side? And what is the benefit to proposal writers of being able to concentrate on science?

Finally, we should have continuity in peer review. The American Association of University Women has two year terms for peer review. I suggest three year staggered terms for every reviewer. This way the comments from one year's reviewer make sense in the next. Diversity is good for science, but when a proposal is tossed back and forth between differing views each year, no one wins. I would like to be the one reviewing that promising proposal that came back with all the wrinkles ironed out; it is a shame for it to go to someone whose wrinkles are different than mine. Let them select next year's set.

Clearly, there are no easy solutions or universal panaceas that will address the problem of equity for women and minorities. But it is equally clear that the problem is not intractable and that serious progress is being made. In order to achieve the twin goals of increasing the numerical participation in STEM fields by women and minorities while at the same time increasing the quality of that participation, I recommend adopting the precepts recommended by the Committee on the Status of Women in Astronomy and adopted by the American Astronomical Society in 2003 for women and minorities in physics. These precepts state that women and men of all races and color, on aggregate, are equally talented and deserve equal opportunity; that full participation of all will maximize excellence in any field; and that equity will have been attained when the percentage of participants in the next level of advancement equals the percentage in the nationally available pool.

In many physical sciences, as well as in math and engineering, the need to increase the pool at the undergraduate level is imperative. Long-term change requires evaluation of progress at frequent intervals, with strategies being revised and new actions activated where improvement is necessary. ■

Please Update Your Address

Dear Gazette Reader,

The APS Roster of Women and Minorities is also used as the Gazette mailing list. If your address has changed and you wish to continue receiving the Gazette, please visit www.aps.org/programs/roster/enroll.cfm to re-register and select The Gazette Mailing List as your Roster group.

Questions? Contact Arlene Modeste Knowles at roster@aps.org.

We'd love to keep you reading the Gazette!

Special Events Focusing on Women and Minorities in Physics

APS February Meeting • Washington, DC • All events will be held in Marriott Wardman Park Hotel

FRIDAY, FEBRUARY 12

8:00am–5:00pm Professional Skills Development Workshop for Women Physicists
Workshop for developing communication, negotiation and leadership skills, for post docs and tenure-track/newly-tenured women physicists (participants must be pre-registered). Reception for participants to follow.

SATURDAY, FEB 13

1:30pm–3:18pm Invited Session D3: Mentoring Perspectives of Mentor and Mentee
Sponsored by Committee on the Status of Women in Physics, the Committee on Minorities, the Forum on Graduate Student Affairs, and AAPT.

6:00pm–8:00pm COM/CSWP Reception (Hoover)
Learn about the work of the Committee on Minorities in Physics and the Committee on the Status of Women in Physics, network with colleagues, and unwind after a long day of sessions. All are welcome.

MONDAY, FEB 15

12:00–1:30pm CSWP/DPF Networking Luncheon (Coolidge)
Buffet luncheon, opportunity for networking with colleagues! Cost: \$20 (\$5 for students). All are welcome, both men and women, however pre-registration by February 1 is strongly advised as there will be only limited space for walk-ins. Pre-register at www.aps.org/meetings/april/events/receptions/index.cfm.

1:30pm–3:18pm Invited Session Q6: Perspectives of Women Physicists As Seen from Academia, National Laboratories, and Industry
Sponsored by the Committee on the Status of Women in Physics, the Committee on Minorities, the Forum on Graduate Affairs, and AAPT.

TUESDAY, FEB 16

10:45am–12:33pm ... Invited Session X2: Strategies for Improving Climate & Diversity in Physics Departments
Co-sponsored by the Committee on the Status of Women in Physics, the Forum on Education, and AAPT.

APS March Meeting • Portland, Oregon

SUNDAY, MARCH 14

8:00am–5:00pm Professional Skills Workshop for Women Physicists (Hilton Portland & Executive Tower Hotel)
Workshop for developing communication, negotiation and leadership skills, for post docs and tenure-track/newly-tenured women physicists (participants must be pre-registered). Reception for participants and others to follow, co-sponsored by the University of Oregon Department of Physics.

TUESDAY, MARCH 16

7:30am–9:30am CSWP/FIAP Networking Breakfast (Galleria I, Hilton Portland & Executive Tower Hotel)
Enjoy a full breakfast and network with colleagues! Cost: \$15, \$5 for physics students, thanks to FIAP's generosity. All are welcome, both men and women, however pre-registration strongly advised by March 5, as only limited walk-ins accepted. Pre-register at www.aps.org/meetings/march/events/receptions/index.cfm.

11:15am–2:15pm Invited Session: What Works for Women in Physics: Lessons Learned from Research[®] (Convention Center) Sponsored by the Committee on the Status of Women in Physics and Committee on Minorities.

2:30pm–5:30pm Invited Session L5: Promoting Excellence: Preparation, Execution, and Opportunities (Convention Center) Sponsored by the Committee on Minorities.

WEDNESDAY, MARCH 17

7:30pm–9:30pm COM/CSWP Dessert Reception (Council Suite, Hilton Portland & Executive Tower Hotel)
Learn about the work of the Committee on Minorities in Physics and the Committee on the Status of Women in Physics, network with colleagues, and unwind after a long day of sessions. All are welcome to join us.

Please check dates and times of all events on the Meetings and hotel calendars, as they may change nearer the time!

The American Physical Society 2010-2011 Travel Grants for Women Speakers Program

Limited funding is available for the
2010-2011 academic year!
Apply online at
[www.aps.org/programs/
women/speakers/
travel-grants.cfm](http://www.aps.org/programs/women/speakers/travel-grants.cfm)

Purpose The program is intended to expand the opportunity for physics departments to invite women colloquium/seminar speakers who can serve as role models for women undergraduates, graduate students and faculty. The program also recognizes the scientific accomplishments and contributions of these women physicists.

Grant The program will reimburse U.S. colleges and universities for up to \$500 for travel expenses for one of two women colloquium/seminar speakers invited during the 2010-2011 academic year.

Qualifications All physics and/or science departments in the United States are encouraged to apply. Canadian and Mexican colleges and universities are also eligible, provided that the speakers they invite are currently employed by U.S. institutions. Invited women speakers should be physicists or in a closely related field, such as astronomy. Speakers should be currently in the U.S. The APS maintains the Women Speakers List which is available online at www.aps.org/programs/women/speakers/enroll.cfm. However, selection of the speaker need not be limited to this list. Neither of the two speakers may be a faculty member of the host institution.

Guidelines Reimbursement is for travel and lodging expenses only. Honoraria or extraneous expenses at the colloquium itself, such as refreshments, will not be reimbursed.

Application The Travel Grants for Women Speakers Application Form (www.aps.org/programs/women/speakers/travel-grants-app.cfm) should be submitted to APS identifying the institution, the names of the two speakers to be invited and the possible dates of their talks. Please note that funds for the program are limited. The Travel Grants for Women Speakers Application Form should be submitted as early as possible, even if speakers and dates are tentative, or if the speakers are scheduled for the spring semester. The application form will be reviewed by APS, and the institutions will be notified of approval or rejection of their application within two weeks. Institutions whose applications have been approved will receive a Travel and Expense Report Form to submit for reimbursement.

See following page for application form.

Women Speakers List

Need a speaker? Consider consulting the American Physical Society Women Speakers List (WSL), an online list of over 300 women physicists who are willing to give colloquium or seminar talks to various audiences. This list serves as a wonderful resource for colleges, universities, and general audiences. It has been especially useful for Colloquium chairs and for those taking advantage of the Travel Grant Program for Women Speakers. To make the WSL easy to use, we have made the online version searchable by state, field of physics, or speakers' last names.



If you'd like to search the list to find a woman speaker, go to:
www.aps.org/programs/women/speakers/index.cfm.

Women physicists who would like to be listed on the Women Speakers List or those who would like to modify their existing entries can do so at:
www.aps.org/programs/women/speakers/enroll.cfm or see page 15.

APS has a companion program for minority speakers. Information on the Minority Speakers List and the Travel Grant Program for Minority Speakers can be found at:
www.aps.org/programs/minorities/speakers/index.cfm.

2010-2011 TRAVEL GRANTS FOR WOMEN SPEAKERS

◆ APPLICATION FORM ◆

This form is also available on the Internet at www.aps.org/programs/women/speakers/travel-grants-app.cfm

This form must be filled out and approval received from the APS in order to be eligible for up to \$500 travel reimbursement.

Please note that submitting this application form does not guarantee reimbursement.

You will be notified within two weeks of receipt of this application whether or not it has been approved.

DATE: _____		
INSTITUTION: _____		
DEPARTMENT: _____		
ADDRESS: _____		
CITY: _____	STATE: _____	ZIP: _____
APPLICATION PREPARED BY (Required):		
NAME: _____	TITLE: _____	
PHONE: _____	FAX: _____	
EMAIL: _____		

Please list information on the speakers below and indicate if speakers' dates or talk titles are tentative.

DATE OF COLLOQUIUM: _____		
SPEAKER'S NAME: _____		
HOME INSTITUTION: _____		
HOME DEPARTMENT: _____		
ADDRESS: _____		
CITY: _____	STATE: _____	ZIP: _____
PHONE: _____	FAX: _____	
EMAIL: _____		
TITLE OF TALK: _____		

DATE OF COLLOQUIUM: _____		
SPEAKER'S NAME: _____		
HOME INSTITUTION: _____		
HOME DEPARTMENT: _____		
ADDRESS: _____		
CITY: _____	STATE: _____	ZIP: _____
PHONE: _____	FAX: _____	
EMAIL: _____		
TITLE OF TALK: _____		

Please return this form to:

Pahola Elder, Travel Grants for Women Speakers Program
 The American Physical Society
 One Physics Ellipse
 College Park, MD 20740-3844
 Tel: (301)209-3232 • Fax: (301)209-0865 • Email: travelgrant@aps.org

◆ ENROLLMENT/MODIFICATION FORM ◆

Additions/Modifications may also be made on the Internet at www.aps.org/programs/women/speakers/enroll.cfm
An online copy of the WSL is also available.

The *Women Speakers List* is compiled by the American Physical Society Committee on the Status of Women in Physics (CSWP).
The list is updated continuously online. Comments, questions and entries should be addressed to:
Women Speakers List • APS • One Physics Ellipse • College Park, MD 20740-3844 • (301) 209-3232

To enroll or update your current entry, please fill out this form completely and return it to the address above.
Please print clearly or type.

Title/ Name Dr. Prof. Mrs. Ms. _____ **Date** _____

Institution _____ **Telephone** _____

Address _____ **Fax** _____

_____ **Email** _____

City _____ **State** _____ **Zip Code** _____

If you have moved out of state, list previous state: _____

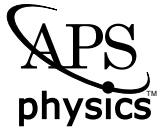
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For which audiences are you willing to speak? (Please check all that apply)

- Middle school High school General Audiences Colloquium

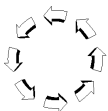
To register a new title, give the title as you want it to appear in the left column below. Then check the section(s) where it is to be inserted. To delete a title, indicate the title and check the appropriate box below. A limit of four total entries will be imposed. You may use additional pages if you are submitting more than four modifications. PLEASE TYPE OR PRINT LEGIBLY PAYING PARTICULAR ATTENTION TO FORMULAS. WE REGRET THAT WE ARE UNABLE TO INCLUDE ILLEGIBLE ENTRIES.

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