

SPECTRUM



A report on underrepresented minorities in astronomy

INSIDE THIS ISSUE

Editor's Note: In this issue of *Spectrum*, we print two editorial articles (see below) regarding the discussion of diversity in the recent Astro2010 Decadal Survey Report.

The 2010 Decadal Survey Report Comes Up Short on Diversity

by Dara Norman, National Optical Astronomy Observatory, & Lou Strolger, Western Kentucky University

On August 13, 2010, the Decadal Survey released the final report of a yearlong effort to survey the astronomy and astrophysics community and identify those major scientific goals, projects and missions that should be priorities for financial support in the coming decade. The report, entitled, "New Worlds, New Horizons in Astronomy and Astrophysics" (available on the web at <http://www.nap.edu/catalog/12951.html>) details the community's strategic plan for the next 10 years.

In addition to the scientific recommendations, the report has also traditionally included information on the status of the astronomical workforce and recommendations for its development. As with the 2000 report, the 2010 Decadal Survey explicitly contains sections dedicated to addressing the status and role of expanding inclusion in professional astronomy and astrophysics to women and minorities. In this report, the main sections that discuss the current state of the astronomical workforce are primarily in Chapter 4, "Astronomy in Society".

Structurally, however, this section is different from previous reports in that the first half of Chapter 4 deals with the role of astronomy and astronomical discovery in the context of public outreach and education at K-college levels, while the second half of the chapter is devoted to the professional workforce. In previous reports, these discussions were part of separate chapters.

Addressed in the second half of Chapter 4 are the broad demographics of the field; who is engaged in which scientific pursuits, what their job positions are and where these positions are located. A full quarter of the chapter is devoted to ta-

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Representing Minorities in the Decadal Survey: the CSMA Takes a Multi-Tiered Approach

by Keivan Guadalupe Stassun, Vanderbilt University

The Astro2010 Decadal Report includes a survey of the field together with recommendations for what should be this decade's top priority facilities and activities as a community. Included in Chapter 4 ("Astronomy and Society") is a summary of the continuing, severe underrepresentation of minorities in the field, along with boldface conclusions that appear also in the report's Executive Summary.

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bles and graphs outlining the makeup of the workforce, leaving only about a quarter of the chapter to discuss the meaning of these demographics for science through the next decade. Analysis of how the workforce needs to develop in order to support the science and missions proposed is lacking from the discussion presented there.

Broadly, this workforce section briefly addresses 4 topics: 1) The role of and need for astronomy professionals to be involved in public policy, 2) The excess numbers of astronomers for traditional academic positions and the realistic need to train the workforce for more varied types of positions, 3) The status of minorities in the astronomical workforce and 4) the status of women in the workforce. Of these, the analysis and discussion of the status of minorities in the workforce seems to be the best developed. Perhaps this is because, as recognized in the report, the statistics are so “abysmal”.

In this section, two cases are made for why it is important for the astronomical community to address the continued underrepresentation in the field by minorities who make up 27% of the US population. The first argument is that by not tapping into this population, intellectual resources are being squandered to the detriment of scientific discovery and US competitiveness in the field. The only other argument made in the report is that there is a lack of role models for youth considering careers in science and technology. While these are perfectly good reasons for the community to take interest, the most important reason is that minority groups are the fastest growing segment of the US population and over the next decade, these groups will make up an even larger fraction of the US workforce (e.g., arXiv:0903.4507). Therefore, the issues of not developing our full intellectual capital will be even more pronounced in the future as we implement the ambitious strategic plan outlined in this report and into the future.

Unlike the section on the status of women in astronomy, the section on minorities does put forward a detailed list of “approaches that might be adopted” by the community to improve the situation. However, it is notable that NONE of these are in the form of recommendations and furthermore none of these approaches are addressed to any particular segment of the community to pursue. This leaves ownership for addressing these issues in limbo and would seem to give the approaches little weight, even the seemingly least controversial of these approaches, such as mentoring programs and family-friendly policies, which would benefit

the entire astronomical workforce as well.

However, the major problem of this workforce section of Chapter 4 is that there is an utter failure to connect each of these workforce issues to the success of the scientific plan that is the heart of this document. This is true for all four topics and renders the section decoupled from the advances that need to be made in order to promote the intellectual, technical and strategic goals of the scientific program outlined here.

This lack of connection is in stark contrast to sections of Chapter 5 where it is made clear that development of the instrumental workforce is integral to the advancement and success of the ambitious scientific program presented. Indeed, the very first introductory section of the report dismisses the workforce sections of Chapter 4 and cites only Chapters 5 and 6 as chapters that discuss “workforce development and other core activities”.

While some might note that given such a major undertaking as the Decadal Survey report, with the large volume of white papers that were submitted and reviewed by the numerous committees assigned to summarize and contribute to the final report, it is a major accomplishment to have had the issue of the poor status of minorities in the fields of astronomy and astrophysics even recognized in the final draft. Moreover, recognized in a way that suggests fairly detailed actions that might be taken by the community to help promote positive change to improve the situation. While certainly this Decadal report outlines a more comprehensive approach to improving the statistics of the minority professional workforce in the field than the 2000 report, this 2010 report has not taken the critical step of identifying the ways in which development of the workforce is integrally tied to the overall success of the scientific mission for the next decade and beyond. Although there are some good ideas presented here for advancing the numbers of minorities in professional astronomy, this report is barely a first step and leaves a great deal of room for improvement in the discussion.

Dr. Dara Norman is an Assistant Scientist at the NOAO in Tucson, AZ. Dr. Norman is an appointed member of the AAS CSMA, and she acts as the AURA Diversity co-Advocate for the NOAO.

Dr. Lou Strolger is an Associate Professor of Physics and Astronomy at Western Kentucky University. Dr. Strolger is currently the chair of the AAS CSMA.

Representing Minorities in Astro2010... (cont'd)

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I served as a member of the Education & Public Outreach Study Group of the Subcommittee on the State of the Profession. This situated me somewhere in the middle of the process by which a very broad base of community input was ingested by the Astro2010 committee structure, considered and evaluated, synthesized, distilled, and ultimately manifested into the final report. I would like to offer some reflections on what I observed of that

process from the inside, including some specific thoughts on what I think the CSMA community did well in getting its message across, and what I think we might have done better.

What the Decadal Report says, and why it's important that it got said

At the most basic level, it was very important that the Astro2010 report explicitly acknowledge the underrepresentation of minorities in our field, and that it state—if even in non-specific terms—that addressing this underrepresentation must be a high priority for the profession and for the funding agencies. Having previously served as a member of the Astronomy & Astrophysics Advisory Committee (AAAC), the Congressionally authorized body that provides guidance to the agencies and to Congress regarding progress on the conclusions and recommendations of the Decadal Report, I witnessed the value and importance of the language contained within the Decadal Report. The report's conclusions and recommendations breathe life into a topic or activity, because the AAAC must connect its annual conclusions and recommendations to those in the Decadal Report.

The 2000 Decadal Report gave the AAAC very little to work with in regards to minorities in astronomy. The subject of minorities comprised three paragraphs, with no specific conclusions or recommendation language flowing from them. The closest thing to a formal conclusion in the 2000 report was the following: "The committee believes that providing all members of the community equal access to professional opportunities will yield the strongest science. Achieving this goal will require the efforts and the support of all members of the astronomical community." (Note that the word 'minorities' did not appear here.) I and other members of the AAAC worked hard to advocate for recommendations in our annual reports that would encourage funding priorities to broaden participation of underrepresented minorities, but motivating such recommendations with the above two sentences from the 2000 Decadal Report was not easy.

It is significant and important, therefore, that the 2010 report includes stronger language, culminating in a formal, boldface Conclusion. The report states: "There are many reasons why improving these abysmal statistics [on minority representation in astronomy] should be a matter of the highest priority." And concludes with: "Agencies, astron-

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SPECTRUM

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News You Can Use

If you would like to contribute stories to 'News You Can Use', send articles and ideas to the Editor: lopez@ucolick.org

CSMA SPONSORS SESSION AT THE JANUARY AAS MEETING ON STRATEGIES TO ADDRESS HARASSMENT & PREJUDICE

The CSMA and CSWA are co-sponsoring a special session on strategies to address harassment and prejudice at the January 2011 AAS meeting in Seattle. The primary goal of this session is to provide practical information on dealing with harassment (both sexual and otherwise) in the workplace and the classroom.

The speakers of the session include Sheryl Bruff from Space Telescope Science Institute, on "Building Respect and Inclusion in Astronomy - Strategies for Understanding and Overcoming Harassment", and Professor Bernice Durand from the University of Wisconsin-Madison, on "What To Do About Inappropriate Behavior". The speakers will provide information on documenting abuses, seeking help and support within as well as outside of one's immediate workplace, and the legal obligations of those to whom the abuse is reported. The organizers encourage attendance by colleagues at all levels in eradicating common and currently accepted prejudice and harassment in our field.

The session will be held on Monday, January 10, at 10:00am-11:30am in Room 4C-4.

AMERICAN PHYSICAL SOCIETY OFFERS SCHOLARSHIP FOR MINORITY UNDERGRADUATES IN PHYSICS

The American Physical Society is offering again the APS Scholarship for Minority Undergraduate Physics Majors. This program began in 1980, and it aims to increase the number of under-represented minorities obtaining degrees in physics. The award consists of \$2000 per year for new minority scholars, and \$3000 per year for renewal students to be used for tuition, room & board, and educational materials. In addition, each student is paired with both a local mentor at their institution, and an APS mentor. These physicist mentors provide support and assistance to the students as they navigate their education and plan for future careers.

To be eligible, students must be African American, Hispanic American, or Native American US citizens or permanent residents who are majoring in or planning to major in physics. Students can

apply as high school seniors and college freshman and sophomores. If you know any minority physics students who would benefit from a scholarship with built-in mentoring, encourage them to apply!

The deadline for completing the application is Friday, February 4, 2011. Learn more and apply online for the scholarship at:

<http://www.aps.org/programs/minorities/honors/scholarship/>

UC SAN DIEGO COMMITS TO 40 FACULTY SEARCHES THIS YEAR, INCLUDING 12 TO ADVANCE DIVERSITY

University of California San Diego has authorized 40 new faculty searches across its campus for the 2010-2011 academic year, and 12 of these are specifically to advance diversity, equity, and climate of inclusion at UCSD. Indeed, this Fall, UCSD posted an ad in the AAS Job Register for an Assistant Professor in theoretical astrophysics/astro-particle physics, where the candidates are to be evaluated "based on research accomplishments and on leadership in areas contributing to diversity".

The move to promote a climate of inclusion at UCSD is part of the university's response to several racially-charged incidents that occurred against African Americans on campus over the last year.

2011 JOINT ANNUAL CONFERENCE OF THE NATIONAL SOCIETY OF BLACK PHYSICISTS AND THE NATIONAL SOCIETY OF HISPANIC PHYSICISTS

The Conference Committee (Co-Chairs: Dara Norman and David Ernst), the Southeastern Universities Research Association (SURA), NSBP and NSHP, are excited to report that the National Science Foundation is awarding SURA \$500,000 to manage the logistics of the 2011 Joint Annual Conference. Bids from hotels had been solicited, but they have all expired. A request for bids has been sent out with a goal of holding the meeting during the last week of March or first few weeks of April. Additional requests are being made for the Fall as a backup should there not be a suitable hotel found for the spring. As details become available, they will be posted on the NSBP (www.nsbp.org) and SURA (www.sura.org) websites.

A Student's Experiences at the 2010 Annual Meeting of SACNAS

by *Brittany Kamai, Fisk University, the Fisk-Vanderbilt Bridge Program*

In my humble opinion, I think everyone should attend a SACNAS (Society for the Advancement of Chicanos and Native Americans in Science) conference at some point in their professional development career. There is absolutely no reason why students should not look into attending since SACNAS awarded over 900 travel awards this year. This included travel to and from the conference with meals and a hotel room. Not bad if you ask me!

To be honest, I had some reservations about attending a conference for the advancement of Chicanos and Native Americans since I am of neither descent. I hoped that I would possibly learn some tips on how to be a professional and possibly make some networking connections. Little did I know what I was actually getting into.

From the first session that I attended on Thursday morning, I knew that I had made the right decision. The topic was applying for fellowships and tips on how to be successful during the application process. The speakers were very powerful at conveying their message of encouragement in applying while putting it into perspective that you may not receive one. All of the speakers shared personal stories of acceptance and rejection and encouraged you to learn from mistakes that you will make. I left my first session very excited to apply for fellowships since prior to this meeting I was busy talking myself out of why I should not apply.

Each professional development session that I attended was very informative about how to make the most of your time at conferences and throughout your entire scientific careers. Apart from the how-to tips that were incredibly useful at this stage in my career, many of the professionals shared personal stories about what they went through. I heard powerful stories from speakers, such as one where the speaker came from being on the verge of suicide to turning themselves around to have a successful scientific career. Another story was of a single mother of three who went from being a poet to a physicist in graduate school. This is just a tiny highlight of the difficult yet incredible stories of how individuals can persevere through professional science careers.

One of the conference objectives was to make networking accessible to a variety of professionals. Meals were geared around networking with profes-



Brittany Kamai (middle), with Kamuela Yong (left) and Lelemia Irvine (right), at the SACNAS meeting in Anaheim, CA. All three students are Native Hawaiian.

sionals and peers in various disciplines of science. Another networking opportunity was an exhibition hall with student scientific poster presentations, university programs, fellowship and industry representatives. During my meals, I was able to engage in some very interesting conversations which related different fields of science. The overall welcoming feeling of the conference really left students feeling accepted into the scientific community and encouraged to keep going. SACNAS did a wonderful job of letting us know there are many people and resources available to help us succeed.

Another thing that made this conference special was that there were other Native Hawaiian students there! I was pleasantly surprised since there are not too many of us to begin with, yet we found each other at this conference. It was very, very encouraging to know that there are other Native Hawaiians being the firsts in their families and help paving the way for our future generations. It was really nice since this conference was very good at reminding you to be true to who you are and what you are doing is important for the future of your culture.

I left this conference completely recharged about becoming a professional scientist. I have learned a lot about how to conduct myself as a professional during conferences, interviews, talks and applications that I am going to quickly put into practice. I want to continue doing cutting edge science by bringing a different perspective that will hopefully advance our understanding of the Universe.

The next SACNAS annual conference will be October 27-30, 2011, in San Jose, CA.

Brittany Kamai is a second-year masters student studying astronomy in the Masters-PhD Bridge program at Fisk and Vanderbilt University.

Youth Astronomy Apprenticeship Program: Addressing STEM Underrepresentation as a Human Capability Realization Issue

By Irene Porro, MIT Kavli Institute for Astrophysics and Space Research

I am an astrophysicist turned science educator, mentor of teenage youth, and advocate for quality STEM learning for urban, underserved teenagers as a social justice cause. It may seem like a long trajectory in a person's personal and professional life, but is it? My scientific background guides me to approach problems in an analytical way and to act to solve them. This is the problem-solving attitude that kicked in when I first started working with Boston teenagers, about ten years ago.

STEM Underrepresentation

Increasing the American STEM (Science, Technology, Engineering, Mathematics) workforce has probably never been such an acute and widely discussed concern as it is today in both the business and education communities. Several studies concerning this issue have been published over the past year: improving the number of people from underrepresented minorities who pursue STEM disciplines and professions has been identified as one of the key mechanisms to increase the overall STEM workforce (National Academy of Sciences, 2010). While this renewed attention to underrepresentation is welcome, we should not forget that both the formal and informal science education communities have been proposing initiatives to support equitable access to quality science learning for the last twenty years. Because a serious underrepresentation of minorities, persons with disabilities and females in the STEM workforce still affects our society today, there is clearly a need to articulate new, creative and coordinated efforts to effectively address this issue.

Results from a recent study by the Higher Education Research Institute at UCLA (HERI, 2010), provide an insight in both the progress and the shortcomings that characterize the education initia-



Dr. Irene Porro (right) with Youth Astronomy Apprenticeship students and Kepler

tives implemented to target underrepresentation in the past decades. The study shows that more than 30% of all students entering college today plan to major in a STEM discipline: this data shows a meaningful improvement with respect to the last decade and is representative of a sustained positive trend. Of relevance is the fact that the same fraction of the student population plans to major in STEM both among White and Asian American students and students from Underrepresented Minorities (URM). However, findings from the survey show a low STEM degree completion rate across all racial groups and, most discouraging, strong disparities in STEM graduation rates between URM students (around 20%) and their White (30-35%) and Asian American (40-45%) peers.

The survey seems to indicate that we have been engaging K-12 students successfully enough for them to enroll in college and to be willing to pursue a major in a STEM discipline. Somehow however, the same students are either not well enough prepared when they enter college and/or not ade-

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quately supported during their early college years to actually complete a STEM major. This is obviously a complex issue that needs a multi-pronged approach: on one side it requires an analysis of the college experience of URM students to be used to create more inclusive academic environments at many of the STEM departments across the country. On the other hand though it is important that we focus on the level of preparation – or lack of it – with which many students from underrepresented groups start college, and on how their high school and college experience connect.

Direct experience and professional studies confirm that many freshmen enter college with a foundation in science and math not strong enough for them to avoid remedial courses and/or to sustain the pace and the standards imposed by college STEM education (Achieve, Inc., 2005, National Academy of Sciences, 2010). While this is true for high school graduates in general, the problem is more acute for URM youth from urban school districts, and it involves more than poor academic performances. To successfully navigate STEM college education and professional environments, young people need skills that make them competitive both among their peers and in the adult world: e.g., the ability to communicate effectively beyond their peer groups, to analyze complex information from multiple sources, to write or present well-reasoned arguments, and to develop solutions to interdisciplinary problems (Partnership for 21st Century Skills, 2004). Teenage youth from underserved communities, however, are the most unlikely to be exposed to specialized STEM work environments and to interact with STEM professionals and other adults who can advise and guide them in personal and academic choices. For underserved URM youths, lack of social capital and status, especially during their late teen years, is a critical factor that often prevents them from receiving both the exposure and the long-term support to follow a STEM career pathway.

An important implication of this analysis is that to effectively address STEM underrepresentation, we need to address it at its roots and to look at STEM underrepresentation as a human capability realization problem, rather than purely as a STEM capacity building problem. In return, a coordinated, long-term education effort aimed to pursuing the well-rounded development of every young person's creative and social potential would lead to an in-

crease in STEM capacity among the U.S. population as well.

Focus on human capability realization is what motivates and guides the design and implementation of the Youth Astronomy Apprenticeship (YAA), an out-of-school time program in astronomy that targets older youth (ages 14 to 19) from underserved urban communities. But, why work with older youth in out-of-school time?

The role of STEM learning in out-of-school time

An increasing body of research suggests that high-quality out-of-school time (OST) programming for older youth is an important tool to boost engagement and graduation rates in high school, enrollment in college, and overall chances to become a productive member of society (Friedman & Bleiberg, 2007). The flexible learning environment available in out-of-school time makes it possible to implement project-based activities that are developmentally appropriate for groups of youth with different skills and knowledge. OST programs can also offer incentives and program attributes that match the specific needs of older youth: at this stage in their lives, adolescents are looking for opportunities to engage socially with each other and for positive relationships with adults, including professionals who provide mentorship and serve as role models.

The out-of-school environment seems indeed ideal for the implementation of STEM initiatives where young people can engage their creativity and develop new skills by interacting with professionals and each other. In order to bring STEM within the OST context however, and to attract the interest of older youth, we need to create learning experiences that are *meaningful* to teenagers and that - by design – require youth to develop personal and interpersonal skills, such as leadership and communication skills. These STEM learning experiences allow youth to appreciate the impact of the scientific enterprise on their life, their community and society at large, encourage youth to work on skills that they would not develop otherwise, and give them the opportunity to share their knowledge with others. In addition, these STEM learning experiences provide youth with the opportunity for effective interactions with adult professionals (in STEM but not only): long term interactions through which youth realize that they can pursue a career in

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Attracting a More Diverse Body of Students to STEM Fields: A Discussion at the Recent ASP Meeting in Boulder

by Kevin McLin, Sonoma State University

The recent meeting of the Astronomical Society of the Pacific, held in Boulder, Colorado, the first week of August, included a Special Interest Group (SIG) convened to discuss issues of diversity as they relate to the field of astronomy and other STEM (Science, Technology, Engineering and Math) fields. The session, titled “Making Connections with Underserved Communities: Broadening Participation in STEM Fields”, was organized by Katy Garmany of NOAO, Tucson. Katy invited a number of people, myself included, to help facilitate the session. In several rounds of email and a teleconference held prior to the Boulder meeting, we narrowed the scope of our session to one that we thought might be manageable (and fruitful) in the limited time allotted. The focus of the SIG is clear from this line in the abstract submitted for the meeting:

“What are the obstacles to making real progress in broadening participation, and what can be started now, at the grass-roots or agency levels, to begin to reduce the worst obstacles?”

As a committee we had decided that our role was not to offer answers to these questions. Instead we wanted to provide a forum where community members could voice their own concerns and share their own experiences. Also, we hoped attendees would begin to think about ways that they and their organizations could begin to take concrete steps toward overcoming the barriers to attracting more minority students into STEM fields. To that end, we posted sheets of paper on the walls around the meeting room and invited arriving attendees to stick post-it notes on them listing the most critical issues they believed impacted minority students and STEM. We then collected these notes and used them to initiate our discussion during the SIG session. We recorded the session so that we would not miss any contributions. This short article attempts to distill what were some of the main themes that broached during our discussion.

The SIG was held for about an hour, just before lunch on Tuesday, August 3. It was attended by roughly 40 individuals from various corners of the astronomy and space science education community, including universities, NASA and the NSF, educa-

tional organizations, and observatories. One thing that was clear at the end of the session: an hour is barely enough time to get started with such a broad topic. As often happens, at the end of our scheduled time period we seemed to be just getting warmed up.

The discussions began with an observation from the audience that India seems to produce a disproportionate number of female scientists (two of whom were in the room). And so the question was put forth, how do they do it? One explanation offered was that all Indian students must study math, whether they like it or not. Clearly, one obstacle to studying science is poor mastery of mathematics, so requiring all students to study math will increase the pool of people qualified to go on in STEM. Another explanation was that in Indian culture education is highly valued, technical education especially so.

One participant pointed out that education is also valued in the US, certainly among the middle and upper classes. However, in some minority communities education tends not to be as valued, or at least does not receive the same focus. Several reasons for this were proffered. For instance, in many minority communities, parents themselves do not have a high level of education. As a result they sometimes do not know how to encourage their children toward academic excellence, even if they would like to do so. In addition, working class children can feel pressure to begin working to help support their families, and this pressure takes focus away from school. Audience members suggested that one way around these obstacles was outreach efforts targeting not just students, but also their parents and their communities. Buy-in from the broad community, not just educational leaders, was seen as vital in changing attitudes within that community. These sorts of outreach efforts require a long-term commitment from scientists and educators to allow strong personal relationships to be built up between the scientists/educators and community leaders. Unfortunately, those types of long-term commitments can be difficult to build and maintain. They generally require a strong personal commitment from some individual with the means to see them through.

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Another point made was that even when minority students do go to college, they tend to have lower than hoped for success rates, and they tend not to enroll in STEM classes. This can have a number of causes. One is probably poor academic preparation, as the students might well have come from schools that are poorly equipped, and where their teachers' training and preparation in STEM was inadequate. Probably another factor is cultural: Colleges and universities tend to be institutions of the upper and middle classes, and minority students often do not see themselves reflected in the ranks of the faculty or the bulk of the student body (and often even less so in STEM disciplines than in the college at large). Given these social and academic barriers, connecting minority students with appropriate mentors and getting them help with classes if necessary can make a tremendous difference.

Some of the other barriers mentioned were discussed briefly (or in some cases not discussed for lack of time). These included a lack of proper scientific language within some communities, and the need to create new vocabulary before we can even begin to discuss science, cultural prejudices regarding science and math, cynicism ("this doesn't matter") with these communities, misperceptions of what STEM careers are, and conflicting world views and the ability of people to hold more than one world view. There were many others, but this gives a flavor of what some of the ideas on the post-it notes were like.

So, given these and other obstacles faced by minority students, what can we do as scientists and educators? Clearly the societal problems of poverty and unequal access to resources are beyond our ability to solve. However, several steps we can take to mitigate these problems were brought up. For instance, outreach can involve both students and parents, and can be a good way to reach out to underserved communities and to begin to change attitudes about education (and science) within them. Again, it is not that these people are hostile to education. Sometimes they don't see it as a realistic option for them or their children. Or they might not know how to access available educational pathways. After-school programs can provide regular contact with members of the broader scientific and educational community that can help them realize new possibilities for themselves. In some communities (mine is an example) universities have taken

it upon themselves to offer financial, academic, mentoring and other assistance to incoming students from non-traditional backgrounds, creating a bridge from their high school to the unfamiliar college setting. Another outreach experience is provided by Project Astro, a program sponsored by ASP that partners astronomers (both amateurs and professionals) with classroom teachers and students around the US. As was pointed out by one of the SIG participants, these kinds of relationships between educational institutions and the community can have profound and lasting impacts, so long as they are long-term and the community feels a level of commitment that bridges the divides that have often built up.

This article cannot give a full accounting of the discussions held in Boulder in August, nor could those discussions have exhausted all there is to say about minority participation in STEM fields; we were not even able to address all the points people had written on their post-it notes, and were in the midst of a lively conversation when our allotted hour came to an end! However, we hoped that those discussions would be a fruitful beginning to an ongoing dialog within the scientific and educational establishments: How can we as individuals, through our professional organizations or direct personal actions, begin to increase the number of students from underserved communities who are both qualified and enthusiastic about studying science and math? This article is merely a way to continue the conversation and broaden it to a wider audience.

For those who want to read more about our Boulder ASP session, a longer description is given in our upcoming conference proceedings (Garmany et al. 2010). Hopefully we will be able to move this dialog forward in future national and regional meetings in ways that lead to a positive impact on the numbers of minority students who see college as a viable option, and STEM as a rewarding career choice.

Dr. Kevin McLin works in the NASA Education and Public Outreach Group at Sonoma State University.

The National Indian Education Association 41st Annual Meeting in San Diego

By Katy Garmany, National Optical Astronomy Observatory, John Leibacher, National Solar Observatory, & Janice Harvey, Gemini Observatory

The National Indian Education Association is the oldest and largest group representing American Indian, Alaska Natives, and Native Hawaiian educators and students. In October, AURA (Association of Universities for Research in Astronomy) sponsored a booth at the NIEA annual meeting in San Diego. AURA is particularly interested in Native American issues since both Kitt Peak National Observatory and Gemini North are located on Native lands. There were just over 2,000 registered attendees at the meeting, including representatives from school districts that enroll primarily American Indians and many colleges, as well as tribal Elders and educators at all levels. The four-day format included morning general assemblies, afternoon workshops on a variety of topics, and the trade show. A flavor of the range of workshops included Native Language revitalization, health and wellness, high school dropout rates, regional caucuses, elders network, and many pipeline issues. Evening activities included a social pow wow, at which dancers from tiny tots to adults enjoyed themselves, and on the final evening, a banquet and awards ceremony.

At the AURA booth, we provided handouts and talked with many people about what the national observatories provide. Gemini offered the Polynesian Voyaging and Wayfinding curriculum for use in the StarLab Portable Planetarium. The curriculum was developed for use with the Polynesian cylinder, written by the Polynesian Voyaging Society, Gemini Observatory and Dr. Richard Crowe from the University of Hawaii at Hilo. STSCI's View Space, an internet-fed, self-updating, permanent exhibit was available for people to see. Steve Pompea (NOAO) set up a Galileoscope that many people enjoyed and which led to many discussions with teachers and representatives of school districts. We had handouts describing the NSF-Funded Research Experience for Undergraduates (REU), Research Experiences for Teachers (RET), and International Research Experiences for Students (IRES) programs at NSO and NOAO.

What astronomy is, what observatories do,

what astronomers do are questions that we were asked many times, as well as how these relate to Native American views on creation. Several mentioned that they felt that while they had a history of studying the sky and stars, that this tradition had been lost. But a question we ask ourselves is why are there so few Native American astronomers? There is certainly precedence. Kitt Peak National Observatory is located on the Tohono O'odham Nation, the second largest reservation in the US. (For an introduction to the history of Kitt Peak and the Tohono O'odham nation see posted talks by Bernard Siqueros, Education Curator of the Tohono O'odham Cultural Center, and Aiden Meinel, the first Director of Kitt Peak at: www.noao.edu/kp50/kp-history.php. The four-meter Advanced Telescope Solar Telescope (ATST) is planned for construction on the summit of Haleakalā ("House of the Sun"), Maui, and sensitivity to native Hawaiian issues has played an important part in the development process.

A superficial answer to our question about Native American astronomers may be related to the observation that out of some 60 workshops and forums, there was nothing that related to physical sciences, including astronomy. A representative of AISES (American Indian Science and Engineering Society) commented that most Native American students do not see a subject like astronomy as relevant to their lives. The NSF, for 2006, identified about 486,000 graduate students enrolled in science and engineering fields: of these, 2,000 are Native American (0.4%). For comparison, Native Americans make up about 1% of the US population. In recent years, there is an average of one physics PhD per year awarded to a Native American. We are aware of only one PhD astronomer who is native Hawaiian.

At a workshop on applying for college scholarships (the Bill and Melinda Gates Millennium scholarships), the administrators stressed the importance of getting students to submit the application on time: they pointed out that some years they did not receive as many applications as they could

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The Association of Universities for Research in Astronomy (AURA) booth at the 41st Annual NEIA meeting. The AURA exhibit featured educational outreach activities of the four AURA centers: Gemini, NOAO, NSO, and Space Telescope Science Institute.

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have filled.

A sobering example of what faces Native American students in college was provided at a workshop on college life. The six students, primarily enrolled at different California colleges, described their experiences. In response to the moderator's questions, almost everyone had a searing and disturbing story about an event on their campus that was disrespectful and painful to them, and to us: (posters for a dance with the title "Cowboy bros and Navajo h...", a native American student asked by dorm mates for "feathers, or something for a costume", etc.). Fortunately, these experiences did not seem to deter them from their education, and they had counterexamples of mentors who supported them. They all mentioned how important mentorship and support groups were in making them feel at home on the campus.

There were signs of progress in other areas also. One evening included a program on Native Americans as portrayed in the movies. Producer-Director Victoria Mudd showed progress over time in the portrayal of Native Americans, especially with the recent inclusion of native filmmakers. She

included clips of films from over the years: while "Dances with Wolves" got a mixed reaction from the audience, "Smoke Signals" was clearly an audience favorite!

All of us made many interesting contacts during the conference. It was a very worthwhile experience, and we hope that other STEM representatives will join us at next year's NIEA meeting to be held in Albuquerque, NM.

Dr. Katy Garmany is an Associate Scientist and Senior Science Education Specialist in the Office of Education and Public Outreach at the National Optical Astronomy Observatory. Dr. Garmany is the AURA Diversity co-Advocate for the NOAO.

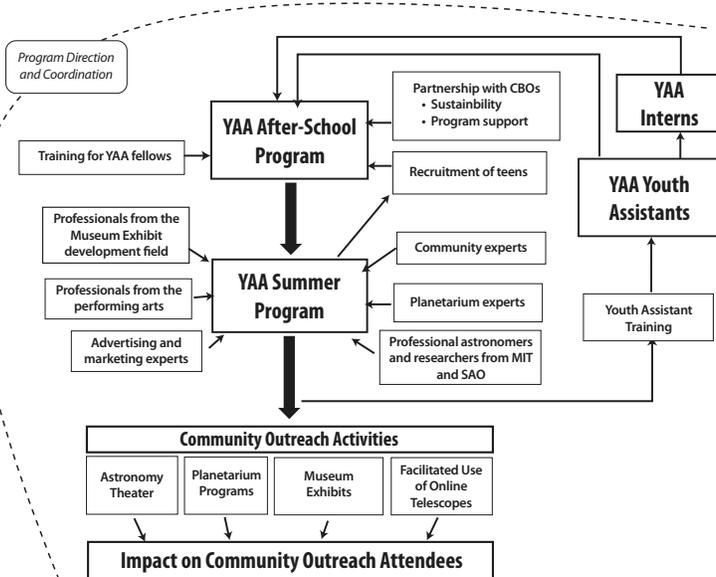
Dr. John Leibacher is an astronomer at the National Solar Observatory.

Dr. Janice Harvey is an administrator at Gemini Observatory in Hawaii, where she is the head of education, outreach, and media there.

Youth Astronomy Apprenticeship Program... (cont'd)

The YAA program progressively develops youth's science knowledge and 21st century employable skills through an apprenticeship model with several stages:

- After-School Program:
Youth as Trainees
- Summer Apprenticeship Program:
Youth as Apprentices
- YAA Outreach Program:
Youth as Science Ambassadors
- Youth Assistant Program:
Youth as Agents of Change
- YAA Internship:
The Future Generation of YAA Instructors and Informal Science Educators



A schematic of the direction and coordination of the several stages of the YAA program.

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STEM if they want to (opposed to because they have to).

By providing a continuum of opportunities for increased responsibilities and leadership roles, OST programs can indeed succeed in engaging most teenagers in a variety of STEM activities, independently of individual motivation. At the same time, by promoting engagement in STEM for a large base instead of a selected number of youth with declared interest in STEM, the number of young people who become STEM advocates, and decide to pursue STEM career pathways, automatically increases.

The YAA program

In the YAA model – designed and developed by the Education and Outreach Group at the MIT Kavli Institute (MKI) – equal effort is put in pursuing science learning for academic enrichment and in stressing the link between employable skills and the skills developed in science and other professional fields. A key strategy in this effort is to provide continuity of support and mentoring, and opportunities for deeper learning and increased personal responsibilities: YAA youth start as unpaid trainees, transition to paid apprentices, then to teaching assistants, and some of them eventually land intern positions at MKI.

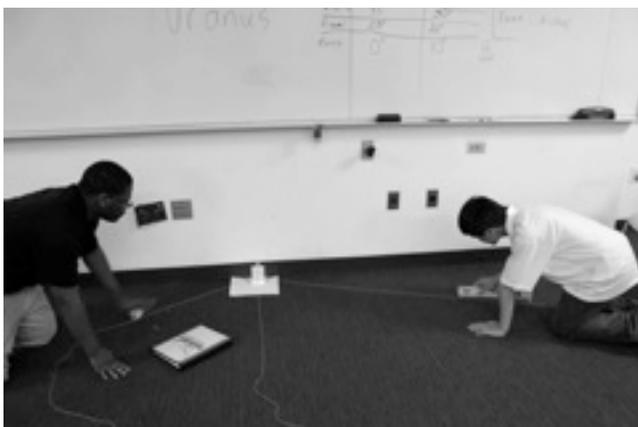
In the training stage (after-school sessions), youth engage in astronomy investigations based on

the use of the MicroObservatory robotic telescopes (created and managed by the Harvard-Smithsonian Center for Astrophysics - CfA) that they can operate via the Internet, learn to use software tools to process astronomical images, and give public presentations about their investigations.

In the following stage eligible youth become apprentices: during the summer they spend eight weeks at MIT charged with the task to create astronomy outreach projects. Learning from and working with performing artists, scientists and science educators from MKI and the CfA, exhibit designers and developers and professionals in marketing and advertising, the YAA apprentices write and perform astronomy plays, design and facilitate telescope activities, create components for professional museum exhibits, and create and run planetarium shows that they perform using a portable planetarium. They then present their projects at local and national science outreach events (in October 2010 the YAA team took part in the USA Science and Engineering Festival in Washington, DC).

Following the summer apprenticeship, some of the youth join the MKI staff to work as youth assistants for YAA after-school programs. With additional training and under the mentorship of MKI staff, youth are gradually empowered to share their knowledge and passion for science with other youth. These young science ambassadors are now role models to their peers: through their work they show that, contrary to a widespread teenage urban

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YAA students engage in astronomy investigations during after-school sessions (left), and they give public presentations about their work and what they have learned (right).

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culture, to engage in science is actually “OK,” and it can be a rewarding and life changing experience. Eventually, youth that are part of YAA for 2 to 3 years, and are now entering college, have the opportunity to become YAA interns. Interns take part in all activities of the MKI Education and Outreach Group: they are trainers for the adult instructors of Kids Capture their Universe program (a MKI/CfA initiative funded by NASA that targets middle school children), and they further develop their teaching skills to become YAA instructors at the community after-school sites where they started their YAA career. The next generation of YAA facilitators, the interns are an important element for the sustainability of the program itself.

Impact

The results of the program Summative Evaluation (conducted by an external evaluation team from the Institute for Learning Innovation) determined that the YAA program had multiple impacts on youth participants. Findings showed that youth developed *Scientific Habits of Mind* as illustrated by increased scores throughout the program year and higher scores for those participating for multiple years. *Leadership in Science*, the strongest indicator for *Personal and Interpersonal Skills*, had the largest increases in scores for all youth. Youth also experienced gains in *Knowledge of Astronomy*, *Commitment to Science*, and *Understanding of Science and Astronomy* shown by increasing scores across the program year. Of great relevance for the program is that all youth became *Advocates for STEM-related Learning* in their communities. Their reported advocacy increased throughout the program year as well as across years of participation, with youth assistants and interns being the strongest advocates.

The program is now in its fourth year and, at this stage, it is difficult for us to tell how many of the youth who participated in YAA will indeed pursue careers in STEM: though this is an expected program impact for at least a fraction of the YAA participants, it is certainly not the key measure for the success of the YAA initiative. What we consider “success” needs actually to refer back to the concept of human capability realization that is at the foundation of the whole initiative. The kind of success that the YAA program aims to achieve for all its participants is best expressed through the words of one of the YAA interns:

“Now [after being part of YAA] I know that if it is my dream to become an astronomer that there is a person out there that is willing to help me get there. I have an idea now on what it takes to survive out there in the real world, which is all about being responsible and to get done what is asked of you. But the most important of all to me is to do something that I enjoy doing, something that allows me to grow and be a better person over all.”

The YAA program was designed and is managed by the Education and Outreach Group at the MIT Kavli Institute for Astrophysics and Space Research, with support from the Science Education Department at the Harvard-Smithsonian Center for Astrophysics and with funding from National Science Foundation (DRL-0610350). Web: <http://yaa.mit.edu/>

Dr. Irene Porro is the Public Education and Communications Officer for the MIT Kavli Institute, and she is the director of the MKI Education and Outreach Group.

Representing Minorities in Astro2010... (cont'd)

Astro2010 Structure

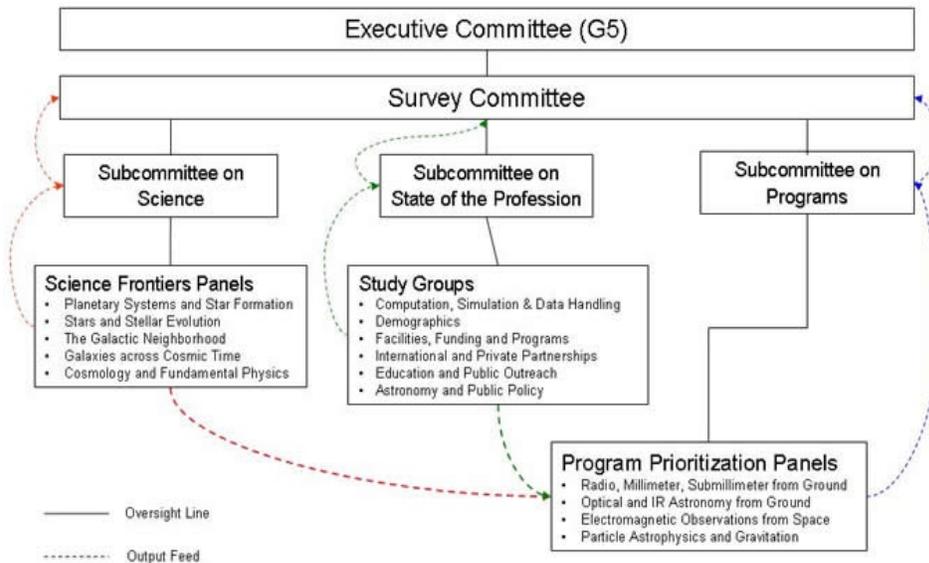


Figure 1: The structure of the Astro2010 survey committees and roles.

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omy departments, and the community as a whole need to refocus their efforts on attracting members of underrepresented minorities to the field.” The latter is not simply a sentence (which includes the word!), it is a formal Conclusion of the report, which elevates it so that official bodies such as the AAAC can track progress on it and hold the agencies to account.

Moreover, the 2010 report includes some specific approaches that may be pursued toward the goal of increasing the number of minority PhD astronomers. These include: Targeted mentoring programs; Partnerships of community colleges and minority serving institutions with research universities, and national centers and laboratories; Expanded funding for programs that ease the transition of individuals across critical junctures in the pipeline—high school to college, community college to university, baccalaureate to graduate school; Funding for master’s to PhD programs; Cross-disciplinary training as an on-ramp to astronomy and astrophysics careers; and Family-friendly policies. Having such a list of possible approaches, backed by footnoted references to relevant statistics and example programs, means that any recommendations to the funding agencies and to the AAS over the next 10 years can specifically point to the 2010 Decadal Report and say, in essence, “... because the Decadal Report says so.”

This is not to suggest that the CSMA won’t need to advocate, to connect the dots in the argument, to persuade. But the explicit acknowledg-

ment and endorsement from the Decadal Report is critically important leverage and ammunition for advocacy by the CSMA community over the coming decade.

How we got the Decadal Report to speak for us: A multi-tiered strategy

That the final report included even one bold-face Conclusion regarding minorities in astronomy, and some specific examples of promising approaches together with supporting data, was no accident. It reflects at least partly the confluence of two critical developments: (1) the Decadal report’s leadership recognized the importance of broad representation within its committee and subcommittee structure, and (2) CSMA members were present in multiple levels of the process.

Three “white papers” focused on the underrepresentation of minorities from K-12 to PhD were submitted to the State of the Profession Subcommittee, and these were largely produced by a coordinated group of astronomers from the AAS’s CSMA. I use the word “coordinated” here deliberately. CSMA members were present at multiple tiers of the Astro2010 committee structure (see Figure 1), including myself on the Education & Public Outreach Study Group and Lou Strolger on the Demographics Study Group, both within the larger State of the Profession Subcommittee, which itself included Neil Tyson within its leadership.

Those of us who were formally part of the committee structure were required to maintain the

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details of its internal discussions confidential. At the same time, we were able to consult in an informal way with our CSMA colleagues who were preparing the white papers, providing advice on the best way to structure the white papers to make them of maximum utility to the Decadal Report committee. For example, we were able to suggest *types and format* of content that would make the white papers most useful—e.g. clear demographics data from credible sources, concrete recommendations, and specific statements about to whom each recommendation should be directed. The CSMA group that produced the white papers, led by Dara Norman, did an excellent job, in my view. Indeed, as a former chair of the CSMA during times when it was sometimes difficult to find “critical mass” within the AAS around issues of minority representation, I was heartened to see a large group of individuals come together through the CSMA and its ‘pan_chromatic’ listserv to produce these excellent white papers that will serve the community well, even beyond their impact specifically on the Decadal Report.

Meanwhile, from within the Astro2010 committee structure, Lou Strolger and I were able to track the progress of the CSMA’s white papers as they moved through the internal process. Of course, it was important that we not push any one white paper or group interest over another. But it was appropriate and important that we were there to help make sure that the important issues (and the valuable data!) presented in them did not slip through the cracks or get lost in the volume of many voices representing the full range of the astronomy community’s concerns. In fact, much of our actual work in the Study Groups was to assemble specific data, to synthesize broad themes, and to distill core recommendations from the many submitted white papers and other sources, which we then passed up the chain to the full State of the Profession Subcommittee for their consideration. Here again it was essential that the white papers as submitted were of such high quality. Of critical importance, these white papers included hard data and specific recommendation language that could be easily and readily adopted by the Decadal survey committee. This made our work within the Study Groups—and I suspect at the higher levels of the process as well—easy.

What we might have done better

Looking back now on the CSMA’s white papers, and on my own work within the Decadal Report’s committee structure, in light of how the CSMA message wound up being manifested in the final Decadal Report, I see now some things that

might have been done better. Perhaps most importantly, the “packaging” of the final report—for example, with minority issues in Chapter 4 and technical development issues in Chapter 5—unfortunately disjoins the issue of minority representation from the broader science vision of the report.

I think the CSMA’s white papers could have made a stronger intellectual link between these core topics. And equally importantly, I think that I and my fellow Study Group members could have better articulated the importance of connecting the topics within our purview with the science aspirations and recommendations of the report. Indeed, it would have been nice if the boldface Conclusion that we got had instead been a boldface Recommendation, which would have conveyed more of a mandate to the AAS and to the funding agencies. Perhaps those of us in the Study Groups did not adequately make the case that the issue of minority representation warranted a statement at the Recommendation level of endorsement. At the same time, there were only so many white papers submitted that addressed the subject of minorities within the professional ranks of the astronomy profession; the Study Groups and the Subcommittee had only so much material to work with. Perhaps the minorities community in astronomy does not yet have that critical mass after all—at least when it comes to visibility and lobbying power within a high-level, profession-wide activity like the Decadal survey.

Even so, on the whole I view the outcome of the Decadal Report in largely optimistic terms. The community of minority advocates with the astronomy community has grown, qualitatively if only barely quantitatively. We were reasonably well organized and coordinated, and we had voice at multiple levels in the process. Most importantly, while we will need to actively remind our colleagues within the AAS and the funding agencies of the Decadal Report’s conclusions that have to do with something other than WFIRST or LSST, this time we have some boldface Executive Summary language to point to. And when WFIRST and LSST do get underway, we can again point to that language, for ultimately it is within the scientific context and vision that the goal of broadening participation in astronomy must be achieved.

Hopefully these reflections will be of value to the CSMA community over the coming decade, and especially when it comes time to get organized for Astro2020.

Dr. Keivan Stassun is an Associate Professor of Physics and Astronomy at Vanderbilt University and is a former chair of the AAS CSMA.

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