

Cross-Referencing the Astronomy and Astrophysics Decadal Survey with CHIPS and Science Act

<p>Pathways to Discovery in Astronomy and Astrophysics for the 2020s The Profession and Its Societal Impacts</p>	<p>CHIPS Act of 2022 CHIPS and Science Act HR 4346</p>	<p>Notes</p>
<p>“The pursuit of science, and scientific excellence, is inseparable from the humans who animate it.” —Panel on the State of the Profession and Societal Impacts</p>		
<p>3.1 PRECEPTS AND PRINCIPLES FOR THE PROFESSION</p> <p>Astronomy and astrophysics enterprise adds substantial, real, and lasting value to the human knowledge infrastructure for the nation and the world.</p> <p>Astronomy’s quest to understand the universe and humanity’s place within it resonates deeply with the public.</p> <p>Investment in astronomy and astrophysics as a science necessarily involves a substantial investment in people, both for the functioning of the field itself and for the many societal benefits that it produces.</p> <p>As physical sciences, astronomy and astrophysics contribute to developing the nation’s technically trained STEM workforce.</p> <p>Astronomical discoveries inspire people to pursue STEM careers</p> <p>NSF’s National Science Board’s Vision 2030 states that, “The U.S. must offer individuals, from skilled technical workers to Ph.D.’s, on-ramps into STEM-capable jobs...In order to lead in 2030, the U.S. also must be aggressive about cultivating the fullness of the nation’s domestic talent.”</p>		

NASA’s Science Plan 2020 states, “As research has shown, diversity is a key driver of innovation and more diverse organizations are more innovative . . . NASA believes in the importance of diverse and inclusive teams to tackle strategic problems and maximize scientific return.”

3.2 ASTRONOMY’S ROLE IN SOCIETY: A GATEWAY TO STEM CAREERS, A BRIDGE BETWEEN SCIENCE AND THE PUBLIC

The solar eclipse on Aug 12, 2017 was watched by an estimated **215 million Americans** (two of every three people) either live or via video stream.

The Event Horizon Telescope image of the black hole in the galaxy M87 posted on the NSF public website in 2019 was **downloaded more times than any other image on a federal government server**.

The detection of gravitational waves from a massive black hole binary by the LIGO-Virgo team in 2016 was the **third highest-impact research story that year** appearing in **more than 900 news media outlets**.

As counterpoint to a period when some have challenged the legitimacy of science and the integrity of scientists, the broad public appeal of astronomy can serve as a force for good far beyond the boundaries of its own discipline.

Conclusion: Astronomy research continues to offer significant benefits to the nation beyond astronomical discoveries. These discoveries capture the public's attention, foster general science literacy and proficiency, promote public perception of the value, legitimacy, and integrity of science, and serve as an inspirational gateway to science, technology, engineering, and mathematics careers.

Training in astronomy and astrophysics continues to pay dividends, whether individuals transition into long-term professional astronomy positions, STEM workforce roles in the private or public sector, or non-STEM related jobs.

The 2017 NSF biennial survey of earned doctorates shows a **less than 2 percent unemployment rate** of individuals with an astronomy master's or PhD degree.

Those joining the private sector with a bachelor's or PhD earn a median **starting income of \$60,000 and \$120,000**, respectively.

The computational and data science skills included in astronomy training and research is in-demand for sectors such as defense, health care, or commerce, as well as teaching in the education sector.

The number of students interested in astronomy has continued to grow resulting in a significant increase in the number of individuals successfully and lucratively taking their astronomy research training into a broad range of STEM careers. **Astronomy**

<p>is now contributing more broadly to the nation’s technically skilled workforce.</p> <p>Finding: Education in astronomy research provides valuable training for a broad array of careers in STEM.</p>		
<p>3.3.1 Where Astronomers Work</p> <p>Funding agencies can drive change because they hold the purse strings for many organizations, universities and researchers.</p> <p>Nearly all of the major facilities supported by NSF and NASA are operated through cooperative agreements, contracts, or other instruments with managing organizations (AURA, AUI, and others).</p> <p>It is not clear what accountability mechanisms the funding agencies have implemented with these organizations.</p> <p>NSF, NASA and DOE should report on their DEI accountability mechanisms implemented through grants, as well as through cooperative agreements and contracts.</p>	<p>TITLE III—NATIONAL SCIENCE FOUNDATION FOR THE FUTURE</p> <p>SUBTITLE C – BROADENING PARTICIPATION</p> <p>Sec. 10324. Broadening participation on major facilities awards. Establishes a requirement for organizations seeking management awards to demonstrate experience and capabilities in employing best practices in broadening participation and directs the Foundation to consider implementation of such practices in oversight of the award.</p>	
<p>3.3.2 Demographics</p> <p>Women remain systematically disadvantaged by gender-associated differences in the distribution of family work and in career-advancing opportunities and resources.</p> <p>Conclusion: Ensuring the movement of women into the top leadership ranks (full professor and beyond) continues to be an important area needing attention.</p>	<p>TITLE III—NATIONAL SCIENCE FOUNDATION FOR THE FUTURE</p> <p>SUBTITLE C – BROADENING PARTICIPATION</p> <p>Sec. 10328. Research and dissemination to increase the participation of women and underrepresented minorities in STEM fields.</p> <p>Supports research and development activities to increase the participation of women and underrepresented minorities in STEM studies and careers, including research studies, mentoring</p>	

	<p>programs, research experiences, and outreach to elementary and secondary school students.</p> <p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE A – STEM OPPORTUNITIES</p> <p>Sec. 10501. Federal science agency policies for caregivers. Requires OSTP to develop guidance to Federal research agencies regarding establishment of policies to provide no-cost extensions and flexibility in award start time to recipients of Federal grants with caregiving responsibilities.</p>	
<p>Racial/ethnic diversity among astronomy faculty remains abysmal.</p> <p>Invest in early-career faculty through dedicated programs such as the NSF CAREER awards.</p> <p>Invest in programs that support intentional transitions of postdoctoral researchers into faculty positions such as NSF Alliances for Graduate Education and the Professoriate (AGEP).</p> <p>Conclusion: Racial/ethnic diversity among astronomy faculty remains abysmal. African Americans comprise a mere one percent of the faculty, over all ranks, among astronomy departments; Hispanics comprise three percent. This collective representation of four percent is roughly an order of magnitude below these groups’ joint representation in the U.S. population.</p>		

<p>Recommendation: Funding agencies should increase funding incentives for improving diversity among the college/university astronomy and astrophysics faculty—for example, by increasing the number of awards that invest in the development and retention of early-career faculty and other activities for members of underrepresented groups.</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE C – MSI STEM ACHIEVEMENT</p> <p>Sec. 10522. Agency responsibilities. Directs OSTP to issue uniform policy guidance for Federal research agencies to improve outreach to MSIs with the goal of increasing awareness among MSIs of funding opportunities and building MSI capacity to submit competitive proposals and successfully manage awards. OSTP is also directed to work with Federal research agencies to develop a strategic plan for how to modify existing or develop new award programs or processes to make Federal STEM education and research funding more accessible to MSIs.</p> <p>Sec. 10524. Capacity-Building Program for Developing Universities. Supports administrative capacity building activities to increase the capacity of MSIs to compete for and manage Foundation research and development awards, including the establishment of MSI Centers of Innovation.</p>	
<p>3.3.3 Pathways (pipeline) into the Profession & 3.3.4 The Role of Federal Agencies</p> <p>Redouble efforts to recruit and support underrepresented students as they move into doctoral programs by:</p>	<p>TITLE III—NATIONAL SCIENCE FOUNDATION FOR THE FUTURE SUBTITLE C – BROADENING PARTICIPATION</p> <p>Sec. 10330. Intramural emerging research institutions pilot program. Authorizes NSF to carry out multiple pilot programs to increase the number and diversity of institutions able to compete for Foundation research and development awards.</p>	
<p>(1) Graduate training that explicitly fulfills culturally relevant career goals.</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE C – MSI STEM ACHIEVEMENT</p> <p>Sec. 10523. Research at the National Science Foundation.</p>	

Training programs that provide a “bridge” for students from undergraduate to doctoral studies— such as the **Fisk-Vanderbilt Masters-to-Ph.D. Bridge Program**, the **CAMPARE program in California**, and the **Columbia Bridge to the Doctorate Program**—have emerged over the past two decades as a promising mechanism for advancing inclusive excellence in astronomy and astrophysics Ph.D. programs.

Fisk-Vanderbilt Bridge Program was funded by NASA and NSF from 2004 to 2013 and was responsible for an average of **six PhDs per year to underrepresented minority students**, representing an increase of 30% since the program began.

Fisk is an HBCU. **HBCUs hold all the slots on a top 10 list of schools graduating the most Black physicists**, despite having departments that are much smaller and have less funding than those at predominantly white institutions (PWIs).

All these programs got their funding start through MUCERPI, PAARE, FaST, or some combination of these and institutional resources.

- NASA SMD’s Minority University and College Education and Research Partnership Initiative (MUCERPI)
- NSF AST’s Partnerships for Astronomy and Astrophysics Research and Education (PAARE)
- DOE Office of Science Visiting Faculty Program (VFP), formerly Faculty and Student Teams (FaST)

Recommendation: NASA, NSF, and DOE should reinvest in professional workforce diversity programs at the division/directorate levels with purview over astronomy and astrophysics.

Supports NSF research on the challenges and successes MSIs have had in contributing to the **STEM workforce**. Supports research focused on building the research capacity of MSIs, encouraging **mutually beneficial partnerships, providing students with research experiences, and scaling up successful model programs for use by other universities**.

Sec. 10525. Tribal Colleges and Universities Program. Requires NSF to award grants through the Tribal Colleges and Universities Program to increase participation in computer science and computational thinking education programs.

<p>Because academic pipeline transitions are loss points in general, supporting the creation and continued operation of “bridge” type programs across junctures in the higher-education pipeline and into the professional ranks appear especially promising.</p> <p>Recommendation: NSF, NASA, and DOE should implement undergraduate and graduate “traineeship” funding, akin to the NIH MARC and NIH “T” training grant programs, to incentivize department/institution-level commitment to professional workforce development, and prioritize interdisciplinary training, diversity, and preparation for a variety of career outcomes.</p> <p>Recommendation: NASA and NSF should continue and increase support for postdoctoral fellowships that provide independence while encouraging development of scientific leaders who advance diversity and inclusive excellence (e.g., NASA Hubble Fellows program, NSF Astronomy and Astrophysics Postdoc program).</p>		
<p>(2) Equity-based holistic review approaches to evaluating individuals. In this case, holistic is the consideration of a broad range of candidate qualities including “noncognitive” or personal attributes.</p> <p>Holistic review is widely viewed as a useful strategy for improving diversity of higher education.</p>	<p>TITLE III—NATIONAL SCIENCE FOUNDATION FOR THE FUTURE</p> <p>SUBTITLE C – BROADENING PARTICIPATION</p> <p>Sec. 10329. Activities to expand STEM opportunities. Supports and incentivizes institutional reform efforts to expand opportunities and development for underrepresented minorities in STEM academic careers and undergraduate STEM studies, including the development and assessment of training courses for administrators – including University Presidents, Vice Presidents, Deans, and Department Chairs – and search committee members to ensure unbiased recruitment and evaluation of underrepresented minority candidates.</p>	

	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE</p> <p>SUBTITLE A – STEM OPPORTUNITIES</p> <p>Sec. 10505. Cultural and institutional barriers to expanding the academic and Federal STEM workforce.</p> <p>Requires OSTP to develop and disseminate guidance to universities and Federal laboratories on best practices to help identify any cultural or institutional barriers limiting the recruitment, retention, and advancement of women and underrepresented minorities in STEM research careers. Directs NSF and Federal research agencies with Federal laboratories to develop policies requiring institutions and laboratories to report on steps taken based on OSTP guidance.</p>	
<p>There are multiple recommendations for funding agencies in the 2015 report, Inclusive Astronomy: The Nashville Recommendations. The AAAC can assess how well NSF, NASA and DOE have made progress on these recommendations in the last seven years.</p>		
<p>3.3.5 Racism, Bias, Harassment and Discrimination</p> <p>The Profession vs. the Professional</p> <p>T</p> <p>he astronomical profession depends on the professionals who push the frontier of the discipline, “The pursuit of science, and scientific excellence, is inseparable from the humans who animate it.” Therefore, organizations that represent the profession should lead efforts to reduce the impacts of racism,</p>		

<p>bias, harassment and discrimination on the individual professional.</p> <p>Impacts could include:</p> <ul style="list-style-type: none"> • threatening professional well-being by producing stress and other negative health outcomes; • equitable participation and advancement by not accounting for differences in experience and mental/emotional load when evaluating performance and outcomes; • economic prosperity and innovation by limiting the degree to which minoritized populations can obtain and maintain jobs in the profession 		
<p>Implement dual-anonymous proposal review procedures for all NASA, NSF and DOE programs in astrophysics.</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE A – STEM OPPORTUNITIES</p> <p>Sec. 10503. Policies for review of Federal research awards. Requires Federal research agencies to regularly assess and update policies and practices to remove or reduce cultural and institutional barriers limiting the recruitment and retention of historically underrepresented minorities, including in reviewing award applications, hiring policies, and workforce policies, and directs agencies to implement evidence-based practices to mitigate bias in the merit review process.</p>	
<p>Recommendation: NASA, NSF, DOE, and professional societies should ensure that their scientific integrity policies address harassment and discrimination by individuals as forms of research/scientific misconduct.</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE D – COMBATING SEXUAL HARASSMENT IN SCIENCE</p> <p>Sec. 10535. Responsible conduct guide. Requires NSF to enter into agreement with the National Academies to update the report On Being a Scientist: A Guide to Responsible Conduct in Research to include updated professional conduct standards, including promising practices for preventing</p>	

	<p>and addressing the negative impact of sexual harassment and promising practices for mitigating research security risks.</p> <p>Sec. 10536. Interagency working group. Requires OSTP to establish or designate an interagency working group to coordinate Federal research agency efforts to reduce the prevalence of sexual harassment involving federally funded researchers and to develop and implement uniform policy guidelines for Federal research agencies.</p> <p>Sec. 10537. National academies assessment. Requires NSF to enter into agreement with the National Academies to undertake a follow-on study to examine the influence of sexual harassment in institutions of higher education on the career advancement of individuals in the STEM workforce and assess progress in implementing recommendations from the 2018 report.</p>	
<p>3.3.6 Data and Accountability</p> <p>Obtaining these critically needed data remains a challenge. First, the agencies do not collect and track the same quantity or categories of demographic data. Second, the policies of the agencies differ concerning public release of information.</p> <p>There is an excellent precedent from the NIH, which has for decades collected demographic information from researchers in its external grants program that is an example for other agencies to emulate.</p> <p>Recommendation: NASA, NSF, and DOE should implement a cross-agency committee or working group tasked with establishing a consistent format and policy for regularly collecting, evaluating, and publicly reporting demographic</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE A – STEM OPPORTUNITIES</p> <p>Sec. 10502. Collection and reporting of data on Federal research awards. Requires each Federal research agency to collect comprehensive demographic data on recipients of Federal awards and to report this data to NSF for summarization and publication. The NSF shall establish and update a policy to ensure standardization of the data collected.</p> <p>Sec. 10504. Collection of data on demographics of faculty. Requires NSF to carry out a survey of STEM faculty demographics at institutions of higher education and to summarize and publish data collected under this section.</p>	

<p>data and indicators pertaining at a minimum to outcomes of proposal competitions.</p>		
<p>3.4.1 Engagement with Local and Indigenous Communities</p> <p>Recommendation: The astronomy community should, through the American Astronomical Society in partnership with other major professional societies (e.g., American Physical Society, American Geophysical Union, International Astronomical Union), work with experts from other experienced disciplines (such as archaeology and social sciences) and representatives from local communities to define a Community Astronomy model of engagement that advances scientific research while respecting, empowering and benefiting local communities.</p>	<p>TITLE V – BROADENING PARTICIPATION IN SCIENCE SUBTITLE B – RURAL STEM EDUCATION RESEARCH</p> <p>Sec. 10512. National Science Foundation rural STEM activities. Authorizes the National Science Foundation (NSF) to support research to advance innovative approaches in STEM teaching in rural schools and improve participation and advancement of rural students in STEM studies, including through a pilot program of regional rural cohorts that provide peer support, mentoring, and hands-on research experiences for rural STEM educators. Directs the NSF Committee on Equal Opportunities in Science and Engineering (CEOSE) to report to Congress an assessment of NSF activities that support participation of rural students in STEM studies.</p> <p>Sec. 10513. Opportunities for online education. Authorizes NSF to support research on online STEM education and mentoring in rural communities.</p> <p>Sec. 10514. National Academies evaluation. Directs NSF to enter into an agreement with the National Academies of Sciences, Engineering, and Medicine for an evaluation of Federal investments in rural STEM education, an assessment of research and data needs, and recommendations for improving STEM education in rural communities.</p>	