

- *Impact*: Increase the respect for the work it takes to lead and build such programs as well as the ability of scientists to engage in such efforts while maintaining active research programs.
- *Programmatics*: Estimated at \$1 million/year/agency to provide extra support for 5–10 grantees (DOE, NASA, NSF).¹¹⁹

N.6.3 Goal 3: Reimagining Leadership

Develop, select, and sustain diverse cohorts of leaders who lead by exercising equity-advancing values.

Expanding astrophysical knowledge in the 2020s requires reimagining leadership. The panel envisions a profession that develops and sustains broadly diverse cohorts of leaders who lead by exercising equity-advancing values. Leadership is a social process by which an individual or a group of individuals with a shared vision act to influence, guide, and motivate members of a group to achieve a desired outcome. The Profession currently relies on hierarchical leadership structures that oversee teams to achieve collective research goals.¹²⁰ Leaders also oversee the processes that distribute resources, evaluate performance, and recognize scientific excellence. How leaders are cultivated, and how they are encouraged to lead, will determine the advancement of the Profession and the individuals within it.

N.6.3.1 Develop and Select Diverse Leaders Who Practice Equity-Advancing Values

Diverse teams can outperform and out-innovate homogeneous teams.¹²¹ Currently, the absence of an equity-based values framework and the associations of leadership with whiteness, masculinity, and elite education¹²² together cause the Profession to preferentially select leaders from over-represented identities and perspectives.¹²³ These selection processes do not take into account the diversity of skills required to support, advance, and execute the scientific mission. Aspiring leaders are expected to change their leadership styles to conventional norms.¹²⁴ Consequently, the Profession's power structure indirectly, but systematically, discriminates and perpetuates the underrepresentation of leaders who lead in diverse ways, including those from historically marginalized groups.¹²⁵ Current and future generations of scientists are looking for leaders not only with conventional scientific reputations but also with expertise in the knowledge and skills to combat systemic inequality within the Profession.¹²⁶ Therefore, there is an acute need for training leaders with multimodal expertise at all career levels. Such leaders are

¹¹⁹ Cost calculated based on 10 PIs per agency with grants of about \$100,000 per year to support their research efforts. This is comparable to current NSF AST spending on REU.

¹²⁰ NRC (National Research Council), 2015, *Enhancing the Effectiveness of Team Science*, Washington, DC: The National Academies Press, doi: 10.17226/19007.

¹²¹ V. Hunt, et al., 2018, "Delivering Through Diversity," The McKinsey Report; C. Díaz-García, A. González-Moreno, and F.J. Sáez-Martínez, 2013, Gender diversity within R&D teams: Its impact on radicalness of innovation, *Innovation*, 15(2):149–160, doi: 10.5172/impp.2013.15.2.149; D. Rock and H. Grant, 2016, Why diverse teams are smarter, *Harvard Business Review*; S.S. Levine, et al., 2014, Ethnic diversity deflates price bubbles, *PNAS*, 111(52):18524–18529, doi: 10.1073/pnas.1407301111.

¹²² H. Liu, 2018, Redoing and abolishing whiteness in leadership, after Leadership, 101–111; L.A. Rivera, 2016, *Pedigree: How Elite Students Get Elite Jobs*, Princeton, NJ: Princeton University Press.

¹²³ E. Cech, 2015, Engineers and engineeresses? Self-conceptions and the development of gendered professional identities, *Sociological Perspectives*, 58(1):56–77, doi: 10.1177/0731121414556543.

¹²⁴ S. Cheryan and H.R. Markus, 2019, Masculine defaults: Identifying and counteracting hidden cultural biases, *Psychology Review*—under review; S.S. Levine, et al., 2014, Ethnic diversity deflates price bubbles, *PNAS*, 111(52):18524–18529, doi: 10.1073/pnas.1407301111.

¹²⁵ See <https://www.nature.com/articles/d41586-020-01741-7>, accessed 26 August 2020.

¹²⁶ See <https://aas.org/press/aas-endorses-vision-statement-inclusive-astronomy>.

defined here as leaders who practice equity-advancing values, including being trained in cultural competency, critical thinking, how to lead discussions inclusively, and how to develop culturally responsible solutions.¹²⁷ These skills are hallmarks of multimodal expertise¹²⁸ and are essential to leading astronomy in realizing a holistic view of scientific excellence. In addition to new programming, existing leadership training programs in astronomy and physics promote training in the advancement of equity-advancing values (e.g., Project Kaleidoscope,¹²⁹ SACNAS Leadership Institute,¹³⁰ PI Launchpad,¹³¹ NSBP/NSHP Student Leadership Summit). These excellent models merit financial support, expansion, and replication. There is no need to wait to diversify astronomy's leadership. Effective leaders with multimodal expertise already exist in the Profession and need to be supported to assume greater roles.

Goal 3, Suggestion 1: The panel suggests that members of the Profession purposefully develop, nominate, and select future leaders with multimodal expertise who exercise equity-advancing values. The panel suggests that federal agencies: (1) update selection processes and criteria to require evidence of ability to lead diverse teams; (2) build programs that incentivize the hiring of leaders capable of supporting underrepresented scientists; and (3) develop leadership pathways that include both training in the practice of equity-advancing values and opportunities for early career leadership.

Method, impact, and programmatics and cost to achieve this suggestion:

- **The Profession**

- *Method:* Update selection criteria for leadership positions throughout the Profession's organizations to include evidence of multimodal expertise through concrete examples where candidates exercise equity-advancing values. Criteria might include demonstrated, quantifiable outcomes—for example, improving institutional culture, building or sustaining effective community partnerships,¹³² demonstrating academic leadership on these topics (publications, lectures, and discussions), and improving recruitment, retention, and advancement of mentees, particularly individuals from historically underrepresented communities.
- *Impact:* Reduce current inequities in access to resources, awards, advancement, and leadership appointments through the selection of leaders who practice equity-advancing values. Select leaders who have the skills needed to support a diverse workforce.
- *Programmatics:* No-cost. Can be implemented immediately.¹³³

- **DOE, NASA, NSF, Academic Institutions, Government Laboratories/Observatories**

- *Method:* Diversify institutions' permanent professional workforces with respect to race/ethnicity/gender and other social identities.²⁸ The panel suggests that institutions and agencies build hiring programs to incentivize the creation of new positions for individuals

¹²⁷ S. Lee, 2020, *Yale Astronomers Questioned Systemic Racism Because They Hired One Black Employee 35 Years Ago, Emails Show*, BuzzFeed, <https://www.buzzfeednews.com/article/stephaniemlee/yale-astronomy-systemic-racism-emails>, accessed 24 August 2020.

¹²⁸ J. Alvehus, 2019, Emergent, distributed, and orchestrated: Understanding leadership through frame analysis, *Leadership*, 15(5):535–554, doi:10.1177/1742715018773832. See also the Section N.5 “Values Statement” in this document. W. Kuepers, 2012, Donna Ladkin, Rethinking leadership: A new look at old leadership questions, *Leadership*, 8:463–467, doi: 10.1177/1742715012444678.

¹²⁹ Project Kaleidoscope (Leadership in STEM Training), <https://www.aacu.org/summerinstitutes/sli/2018>, accessed 24 August 2020.

¹³⁰ SACNAS Leadership Institute, <https://www.sacnas.org/what-we-do/leadership-programs>, accessed 24 August 2020.

¹³¹ PI Launchpad, <https://science.nasa.gov/researchers/pi-launchpad>, accessed 24 August 2020.

¹³² See the Section “Cultivating Local and Global Partnerships” in this document.

¹³³ Requires only additional criteria in selection procedures for leadership positions and awards.

with strong track records in promoting equity-advancing values. Agencies could follow solicitation NSF 19-558, *Faculty Development in the Space Sciences*. The panel further suggests that agencies and institutions classify the recruitment of such employees as critical, with a severe shortage of candidates, and support this priority by utilizing tools at their disposal, such as the Direct Hiring Authority.¹³⁴

- *Impact*: Science leaders with demonstrated equity-advancing skills who support scientists from underrepresented backgrounds.
- *Programmatics*: Estimated at \$4.5 million per agency (DOE, NASA, NSF).¹³⁵
- **DOE, NASA, NSF**
 - *Method*: Build leadership training programs specific to the agency’s leadership structures and include workshops to teach how to implement equity-advancing values as leaders. For example, missions and collaborations might include leadership development in their budgets, and each agency establishes and funds equivalent to the PI Launchpad program. The panel suggests that outcomes from training programs be assessed with longitudinal tracking of participants and reporting of aggregated data.
 - *Impact*: Agencies participate and guide the development of leadership programs that provide equitable access to organization-specific information.
 - *Programmatics*: Estimated at \$120,000 per meeting, per agency.¹³⁶

N.6.3.2 Promote the Exercise of Leadership by Diverse Leaders

STEM organizations have become more diverse primarily through the disproportionate labor of scientists who represent the communities that STEM fields are seeking to better serve.¹³⁷ Individuals with historically underrepresented identities spend significant time on this “invisible” work, with consequences to their research productivity.¹³⁸ True commitment to exercising equity-advancing values must not obscure the racial equity labor that goes into building racial inclusion.¹³⁹ Furthermore, leadership by white women and members of marginalized groups is often unduly scrutinized and criticized.¹⁴⁰ The Profession

¹³⁴ Direct Hiring Authority, <https://www.opm.gov/policy-data-oversight/hiring-information/direct-hire-authority/>, accessed 24 August 2020.

¹³⁵ Annual; estimates are based on NSF 19-558, *Faculty Development in the Space Sciences*. Funding supports 3–4 awards per agency, resulting in 9–12 new hires annually. See <https://www.nsf.gov/pubs/2019/nsf19558/nsf19558.htm>, accessed 24 August 2020.

¹³⁶ Annual; estimates are based on the budget for the NASA PI Launchpad program (E. Hamden, private communication): 40 people attending, plus ~25 mentors/speakers/panelists = \$100,000 operations, \$20,000 travel budget for NASA speakers = \$120,000. Budget for PI Launchpad was largely supported by the Heising-Simons Foundation.

¹³⁷ J. Posselt, 2020, *Equity in Science: Representation, Culture, and the Dynamics of Change in Graduate Education*, Palo Alto, CA: Stanford University Press; K.B. Porter, J.R. Posselt, K. Reyes, K.E. Slay, and A. Kamimura, 2018, Burdens and benefits of diversity work: Emotion management in STEM doctoral students, *Studies in Graduate and Postdoctoral Education*.

¹³⁸ Brown-Nagin, 2016, The mentoring gap, commentary, *Harvard Law Review*, 303:129; C.T. Pittman, 2010, Race and gender oppression in the classroom: The experiences of women faculty of color with white male students, *Teaching Sociology*, 38(3):183–196, doi: 10.1177/0092055X10370120; D.R. Hekman, S.K. Johnson, M.-D. Foo, and W. Yang, 2016, Does diversity-valuing behavior result in diminished performance ratings for non-white and female leaders? *Academy of Management Journal*, 60:2; R.F. Martell, 1991, Sex bias at work: The effects of attentional and memory demands on performance ratings for men and women, *Journal of Applied Social Psychology*, 21:1939–1960.

¹³⁹ V. Lerma, L.T. Hamilton, and K. Nielsen, 2020, Racialized equity labor, university appropriation and student resistance, *Social Problems*, 67:2, doi: 10.1093/socpro/spz011.

¹⁴⁰ M.E. Heilman, A.S. Wallen, D. Fuchs, and M.M. Tamkins, 2004, Penalties for success: Reactions to women who succeed at male gender-typed tasks. *Journal of Applied Psychology*, 89:3; D. Hekman and M.-D. Foo, 2017,

needs to accept and empower leaders with multi-modal expertise by recognizing the value of diverse ways of leading,¹⁴¹ and be willing to be led by people with different ideas, identities, and approaches.

Recognition is one of the core tenets of belonging, critical to the creation of a STEM identity,¹⁴² and a key determinant of retention.¹⁴³ Agencies and the Profession can use powerful levers (awards, grants, prizes, promotion, raises, tenure) to recognize the currently invisible labor of individuals to diversify the Profession. Such levers can help sustain leaders with multimodal expertise who are critical to actualizing equity-advancing values and the strategic plans of agencies/institutions. This establishes the work of promoting equity-advancing values as a core mission of the Profession and a responsibility of its leaders.¹⁴⁴

Goal 3, Suggestion 2: The panel suggests that the Profession sustain and empower leaders with multi-modal expertise, including leaders from historically underrepresented groups, by recognizing their leadership in encouraging equity-advancing values in promotion evaluation and service assignments. This responsibility lies not only with those who select leaders, but also with their peers and those being led.

Method, impact, and programmatics and cost to achieve this suggestion:

- **The Profession**

- *Method:* Recognize and reward leadership that demonstrates equity-advancing values in individual evaluations at all career stages—for example, fellowship applications, awards and review committees, evaluation for tenure and promotion. Account for this leadership when considering service loads within institutions so that scientists from historically underrepresented backgrounds (including women) are not overburdened. Provide meaningful, context-specific rewards for scientists who promote equity-advancing values, which can include service/teaching relief and/or an extra semester of sabbatical.
- *Impact:* Rewarding such leadership influences promotion metrics used at all institutional levels, empowers individuals, particularly those from underrepresented communities, to continue promoting equity-advancing values in the Profession, and encourages others to join in and respect the work of these individuals.
- *Programmatics:* Minimal up-front cost that is ultimately recoverable.¹⁴⁵

- **DOE, NSF, NASA**

- *Method:* Establish Early-Career Leadership Awards and Fellowships to recognize and fund early-career faculty, scientists, postdoctorates, graduate, and especially undergraduate students that work to support the recruitment and retention of historically underrepresented scholars. Create leadership training programs for awardees and existing agency postdoctoral fellows. Self-nominations for awards ought to be encouraged.

Does valuing diversity result in worse performance ratings for minority and female leaders? *Academy of Management Annual Meeting Proceedings 2014*; S.K. Johnson, and D.R. Hekman, 2016, Women and minorities penalized for promoting diversity, *Harvard Business Review*.

¹⁴¹ L. Madhlangobe and S.P. Gordon, 2012, Culturally responsive leadership in a diverse school: A case study of a high school leader, *NASSP Bulletin*, 96(3):177–202, doi: 10.1177/0192636512450909.

¹⁴² H.B. Carlone and A. Johnson, 2007, Understanding the science experiences of successful women of color: Science identity as an analytic lens, *J. Res. Sci. Teach.*, 44:1187–1218, doi:10.1002/tea.20237.

¹⁴³ J.E. Stets, P.S. Brenner, P.J. Burke, and R.T. Serpe, 2017, The science identity and entering a science occupation, *Social Science Research*, 64:1–14. doi: 10.1016/j.ssresearch.2016.10.016.

¹⁴⁴ W. Brown-Glaude, ed., 2009, *Doing Diversity in Higher Education: Faculty Leaders Share Challenges and Strategies*, New Brunswick, NJ: Rutgers University Press.

¹⁴⁵ Requires additional criteria in promotion/selection criteria (no cost). Teaching relief and/or extensions in sabbatical are short-term costs for the institution employing the individuals that can be balanced in the long run by retention and improved performance of employees who improve the climate of the institution.

- *Impact*: Encourages institutions to recognize these individuals and their work to further equity-advancing values.
- *Programmatics*: Financial support for the individual’s research through multi-year awards to scientists (similar to NSF/DOE Early Career Awards), fellowships for graduate students and postdoctorates, and scholarship awards for tuition for undergraduates. Award recipients could receive mentoring from dedicated agency-led leadership training programs (Goal 3, Suggestion 1). Estimated at \$3 million/year NASA, \$3 million/year NSF, \$1.5 million/year DOE.¹⁴⁶

N.6.4 Goal 4: Addressing Harassment and Discrimination

Establish clear policies, collect and report relevant metrics, and enforce accountability measures to remove structures and individuals that perpetrate identity-based discrimination including harassment.

Identity-based discrimination is a core mechanism for preserving inequity within the Profession.¹⁴⁷ It includes both differential treatment (including harassment) on the basis of identity, as well as ostensibly neutral practices that produce differential impacts owing to identity. Identity-based discrimination minimizes equitable access to the resources, infrastructure, and relationships necessary to participate fully in the field, and discourages multimodal expertise by subordinating those historically perceived to be from social out-groups.¹⁴⁸ It erodes the sense of belonging and respect needed for confident engagement, thereby diminishing or altogether eliminating people and their valuable perspectives.¹⁴⁹ Given the pervasiveness of identity-based discrimination (including harassment) in the Profession,¹⁵⁰ the panel emphasizes the need to balance accountability, recourse/reporting and environmental interventions to address and ultimately eradicate unchecked acts of discrimination as well as the standard operating procedures that have disparate or differential impact on individuals in the field.

Pervasive identity-based discrimination in the Profession (be it structural or between individuals, overt or implicit) impacts (1) professional well-being by producing stress and other negative health outcomes; (2) equitable participation and advancement by not accounting for these differences in experience and mental/emotional load when evaluating performance and outcomes; and (3) economic prosperity and innovation by limiting the degree to which minoritized populations can obtain and maintain jobs in the Profession and further a deeper understanding of the universe.

Since 2018, the National Academies have released four consensus reports that have taken a systemic approach in addressing key issues in higher education and academic research: *Graduate STEM*

¹⁴⁶ Annual; estimates based on the following: (1) Scientists: Comparable to NSF CAREER, DOE Early Career Programs (5-year term, 500,000 grants, 6 per year; NASA, DOE, NSF). (2) Graduate/Postdoctoral: Comparable to AAPF/GRFP (~\$100,000 per fellow, selecting ~15 new fellows per year, for 3-year terms; NASA, NSF). (3) Funding for scholarships for undergraduates (\$15,000 per student, 20 students per year, NASA, NSF). Estimate based on data from 2015–2016, “where 78 percent of full-time students at public 4-year colleges and universities had need remaining after grant aid, averaging \$14,400.” Trends in Student Aid 2019, College Board, <https://research.collegeboard.org/pdf/trends-student-aid-2019-full-report.pdf>, accessed 24 August 2020.

¹⁴⁷ NASEM (National Academies of Sciences, Engineering, and Medicine), 2020, *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors*, Washington, DC: The National Academies Press, <https://doi.org/10.17226/25585>.

¹⁴⁸ K. Crenshaw, 1989, Demarginalizing the intersection of race and sex: a black feminist critique of antidiscrimination doctrine, feminist theory and antiracist politics, *University of Chicago Legal Forum*, 1989(1):8.

¹⁴⁹ X. Padamsee, 2017, Unrealized impact: The case for diversity, equity, and inclusion, *Promise54*, July: 52–53.

¹⁵⁰ K.B.H. Clancy, K.M.N. Lee, E.M. Rodgers, C. Richey, 2017, Double jeopardy in astronomy and planetary science: Women of color face greater risks of gendered and racial harassment, *JGR Planets*, 122:1610, <https://doi.org/10.1002/2017JE005256>.

Education for the 21st Century; Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine; The Science of Effective Mentorship in STEMM; and Minority Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce. Each of the committees created reports that situated the issue of sexual harassment and discrimination within the broader culture of higher education, as the committees perceived that incentive and reward systems are critical drivers of behavior in academia. In particular, there is broad consensus that the legal system alone is not an adequate mechanism for reducing or preventing sexual harassment. These reports further highlight the role that federal agencies, which control research funding, can play in enacting long-lasting change.

The National Academies report *Sexual Harassment of Women*^{151,152} highlights the need to address the effects of harassment and discrimination on the integrity of research. This report concludes that “parts of the federal government and several professional societies...focus more broadly on policies about research integrity and on codes of ethics, rather than on the narrow definition of research misconduct.”¹⁵³ The panel is in agreement that scientific integrity has to include how researchers treat people. “Research culture and policies are quick to denounce plagiarism, data fabrication, and mismanagement of funds, yet we have too long ignored the mistreatment of people.”¹⁵⁴ The House of Representatives Committee on Space, Science, and Technology in 2019 held a hearing¹⁵⁵ to investigate efforts to combat sexual harassment in STEM fields. In her opening statement, Chair Eddie Bernice Johnson said, “The public investment in research needs to draw on all of our nation’s talent to return the best possible science for the benefit of society. To reach this goal, we must do more to ensure that all researchers have access to a safe work environment.” “Harassment, bullying, and discrimination damage science at the individual, community, institutional, and societal levels and cause health problems, fear, mistrust, depression, and trauma.”¹⁵⁶ It thus follows that additional consideration needs to be given to safe social spaces, termed “counterspaces,” which provide support and reinforce the sense of belonging in STEM.¹⁵⁷ Counterspaces¹⁵⁸ can enable peer-to-peer relationships that provide academic, social, and/or emotional support, mentoring relationships that help victims navigate how to succeed in the field, and access to campus groups to advance professional skills and develop leadership opportunities.¹⁵⁹ Support programs can take the form of coaching, counseling, and childcare while negotiating the after-effects.

Cultural shifts around identity-based harassment require second-order theories of change (i.e., addressing underlying priorities and norms, not just reforming policy and practice) and an intersectional

¹⁵¹ NASEM (National Academies of Sciences, Engineering, and Medicine), 2018, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*, Washington, DC: The National Academies Press, doi: <https://doi.org/10.17226/24994> (Chapter V.5 and Chapter V.6 and R:13).

¹⁵² Page 170 of that report defines sexual harassment; the panel uses that definition.

¹⁵³ NASEM (National Academies of Sciences, Engineering, and Medicine), 2018, *Sexual Harassment of Women: Climate, Culture, and Consequences in Academic Sciences, Engineering, and Medicine*, Washington, DC: The National Academies Press, doi: <https://doi.org/10.17226/24994> (Conclusion 6).

¹⁵⁴ E. Marin-Spiotta, 2018, Harassment should count as scientific misconduct, *Nature*, 557:141.

¹⁵⁵ See <https://science.house.gov/hearings/combating-sexual-harassment-in-science>.

¹⁵⁶ E. Marin-Spiotta, 2018, Harassment should count as scientific misconduct, *Nature*, 557:141.

¹⁵⁷ D. Solorzano, M. Ceja, and T. Yosso, 2000, Critical race theory, racial microaggressions, and campus racial climate: The experiences of African American college students, *Journal of Negro Education*, 69(1/2):60.

¹⁵⁸ “Counterspaces in science, technology, engineering, and mathematics (STEM) education are often considered safe spaces that, by definition, lie in the margins, outside of mainstream educational spaces, and are occupied by members of non-traditional groups.” From M. Ong, J.M. Smith, and L.T. Ko, 2018, Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success, *J. Res. Sci. Teach.*, 55:206–245.

¹⁵⁹ NASEM (National Academies of Sciences, Engineering, and Medicine), 2020, *Promising Practices for Addressing the Underrepresentation of Women in Science, Engineering, and Medicine: Opening Doors*, Washington, DC: The National Academies Press, <https://doi.org/10.17226/25585>.

lens (i.e., attending to experiences of people with multiple marginalized identities).¹⁶⁰ Harassment continues to be a major concern in our field. In the most recent poll by the Pew Research Center, “among women who worked in male-dominated workplaces, 48 percent said that harassment was a problem. Just under one-quarter of women said that they had been harassed.”¹⁶¹ In spite of the fact that research on gender inequalities in STEM has generated ample strategies in order to achieve gender equity,¹⁶² urgent gaps persist in knowledge about racial discrimination, including how it manifests in educational and professional environments and how it intersects with other forms of discrimination and oppression.¹⁶³ These themes necessitate a great deal of reflection and require an intersectional approach. These include, for example: the experiences of women of color, women with disabilities, LGBTQIA+ women, as well as those involving women in all intersectional identities.

Goal 4, Suggestion 1: Recognize identity-based discrimination and harassment as equally deleterious as research misconduct in terms of its effects on the integrity of research.¹⁶⁴

Method, impact, and programmatics and cost to achieve this suggestion:

- **NSF, NASA, and DOE**

- *Method:* The panel suggests that agencies adopt scientific integrity policies that specifically address identity-based harassment with the same severity as any other research or scientific misconduct, such as fabrication, falsification, or plagiarism. The panel endorses the suggestions of Zellner and collaborators and supports “the provisions of H.R. 36, the Combating Sexual Harassment in Science Act of 2019... The proposed law requires the development and implementation of harassment reporting terms and conditions, like the one used by NSF, at all major science funding agencies.”¹⁶⁵
- *Impact:* The panel identified grantmaking authorities as the optimal actors. Adding new terms and conditions directed specifically at harassment and discrimination to the agencies’ proposal policies would place it alongside numerous other requirements that institutions already agree to every year when they accept funding.
- *Programmatics:* No-cost. Could be implemented in 1–2 years.

- **NSF, NASA, and DOE**

- *Method:* Hold individuals and institutions responsible for harassment and discrimination. Establishing sexual harassment as a serious issue would require that federal funding agencies be notified by funded institutions when principal investigators, co-principal investigators, and grant personnel have violated sexual harassment policies.¹⁶⁶

¹⁶⁰ S. Elrod, and A. Kezar, 2016, *Increasing Student Success in STEM: A Guide to Systemic Institutional Change*, Washington, DC: Association for American Colleges and Universities.

¹⁶¹ Race- and gender-based bias persists in US science, 2018, *Nature*, 554:561. doi: <https://doi.org/10.1038/d41586-018-02175-y>

¹⁶² T. Feder, 2017, 2017, Widespread harassment reported in astronomer survey, *Physics Today in Politics and Policy* 21(July).

¹⁶³ C. Prescod-Weinstein, 2020, Making Black women scientists under white empiricism: The racialization of epistemology in physics, *Journal of Women in Culture and Society*, 45(2).

¹⁶⁴ “Related Findings and Suggestions,” *Sexual Harassment of Women*, Chapter V and Recommendations 3, 4, 13, and 14,

¹⁶⁵ N. Zellner, J. McBride, N. Morrison, A. Olmstead, M. Patterson, G. Rudnick, A. Venkatesan, et al., 2019, “Findings and Recommendations from the American Astronomical Society (AAS) Committee on the Status of Women In Astronomy: Towards Eliminating Harassment in Astronomy,” white paper submitted to the Astro2020 Decadal Survey, <https://arxiv.org/abs/1908.00589>.

¹⁶⁶ “Findings and Conclusions,” *Sexual Harassment of Women*, Chapter V, Number 5.

- *Impact*: Increases incentives for institutions. Creates accountability partnerships between agencies and institutions; sets expectations of accountability and consequences throughout the field.
- *Programmatics*: No cost. Can be implemented in 1–2 years.
- **Academic Institutions**
 - *Method*: The panel suggests that academic institutions consider identity-based discrimination as equally important as research misconduct and increase collaboration among offices that oversee the integrity of research in order to provide more resources to handle complaints and implement sanctions.¹⁶⁷
 - *Impact*: By enforcing consequences for identity-based discrimination as a violation of research integrity, institutions can be better equipped to remove individuals and systemic structures that perpetrate identity-based discrimination.
 - *Programmatics*: No-cost. Can begin in the first year.
- **Professional Societies**
 - *Method*: The panel suggests that professional societies seek to eliminate harassment and discrimination in their activities, particularly conferences and scientific publication, and throughout the profession by providing resources and setting high community-based standards of conduct.¹⁶⁸
 - *Impact*: Would lower the tolerance for harassment and discrimination within the Profession, and promote grass-roots changes in behavior.
 - *Programmatics*: No-cost. Can be implemented immediately.

Goal 4, Suggestion 2: Support individuals marginalized by harassment and discrimination.¹⁶⁹

Method, impact, and programmatics and cost to achieve this suggestion:

- **Professional Societies and Private Foundations**
 - *Method*: The panel suggests that professional societies and private foundations convene working groups that can effectively assess how funding can be provided for mental health and well-being, legal counseling, and other support structures for survivors.
 - *Impact*: Individuals impacted by discriminatory practices or harassment require a range of support options that can be facilitated by flexible funding that allows them to make arrangements that best suit their needs.
 - *Programmatics*: Convened working groups could include participation by representatives of funding agencies. Options might include support for dependents or caregivers or for new and existing counterspaces designed to mitigate the negative impacts of identity-based discrimination.
- **Academic Institutions**
 - *Method*: The panel suggests that academic institutions support new and existing counterspaces designed to mitigate the negative impacts of identity-based discrimination.
 - *Impact*: “Creating counterspaces, alongside inclusive policies that guard against racism and sexism (and other forms of discrimination), [enhances the] learning environment and the opportunity for all to succeed.”¹⁷⁰

¹⁶⁷ *The Sexual Harassment of Women*, Recommendation 4.

¹⁶⁸ S. Sardelis, S. Oester, and M. Liboiron, 2017, Ten strategies to reduce gender inequality at scientific conferences, *Frontiers in Marine Science*, 4:231.

¹⁶⁹ “Related Findings and Suggestions,” *The Sexual Harassment of Women*, Recommendations 4, 13, and 14.

¹⁷⁰ M. Ong, J.M. Smith, and L.T. Ko, 2018, Counterspaces for women of color in STEM higher education: Marginal and central spaces for persistence and success. *J. Res. Scie. Teach.*, 55:206-245.

- *Programmatics*: Could be done as an institutional program in campuses around the country.
- **NSF, NASA, DOE, and Academic Institutions**
 - *Method*: The panel suggests that agencies and institutions design and fund training that focuses on cultural humility and bystander-intervention. While cultural competency focuses on providing practitioners the ability to understand, communicate with, and effectively interact with people across cultures,¹⁷¹ cultural humility is a way of being with ourselves, others, and the institutions we inhabit.¹⁷² It asks not only that we assess our environments and engage them in an unbiased and nonviolent manner but also that we reflect deeply on who we are and how we show up for others.
 - *Impact*: Changes discriminatory evaluation and decision-making processes within the Profession through training to reduce inequities in participation and leadership within the field.
 - *Programmatics*: Minimal cost. Could be implemented in 1–2 years.
- **NSF, NASA, and DOE, and Institutions**
 - *Method*: Because lack of access is a form of discrimination, the panel suggests that institutions consider developing accessibility plans to identify the current state of facilities and plans for increasing access.
 - *Impact*: Accessible spaces encourage equal participation.
 - *Programmatics*: Accessibility plans can be implemented in 1–2 years.

N.6.5 Goal 5: Removing Barriers

Modernize practices that have disparate impact on access to education, training, and advancement.

Scientific excellence depends on ensuring that each generation of scientists can thrive within the environments in which they learn and work, and requires equitable access to education, advancement opportunities, funding, and facilities. Astronomy is a dynamic field, both culturally and technologically, and training (including teaching practices, curriculum, and technical/professional development) that reflects the current state of evidence-based, inclusive practice is needed. Physics and mathematics instruction is the gateway to the Profession and must be modernized nationwide. Inequities in career advancement and access to the tools of the Profession must be addressed so that the entire workforce is engaged. See also the driving motivation for SEA Change,¹⁷³ an effort of the American Association for the Advancement of Science to effect sustainable change with regard to diversity, equity, and inclusion in STEM¹⁷⁴ at U.S. institutions of higher education.

N.6.5.1 Work with Physics Departments to Incentivize the Widespread Adoption of Research-Based Instructional Strategies and Inclusive Pedagogy in First-Year Physics

The first-year sequence in physics is among the most influential in a student's chances to continue not only in astronomy but also in all STEM fields. This sequence, along with calculus, have drop, fail, or withdrawal (DFW) rates of 30 percent or more, and first-generation (First Gen), Pell-eligible

¹⁷¹ T.L. Cross, B.J. Bazron, K.W. Dennis, and M.R. Isaacs, 1989, Towards a Culturally Competent System of Care, *NCJRS*: 12439.

¹⁷² R. Danso, 2018, Cultural competence and cultural humility: A critical reflection on key cultural diversity concepts, *Journal of Social Work*, 18(4):410–430, doi:10.1177/1468017316654341.

¹⁷³ See <https://seachange.aaas.org/>.

¹⁷⁴ Science, technology, engineering, mathematics, and medicine (STEMM).