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EDITED AND REVIEWED BY
Joseph E. Borovsky,
Space Science Institute (SSI), United States

*CORRESPONDENCE
Michael W. Liemohn,
liemohn@umich.edu

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Editorial: Driving towards a more diverse space physics research community—perspectives, initiatives, strategies, and actions

Michael W. Liemohn[1]*, Mcarthur Jones Jr[2], Xochitl Blanco-Cano[3], John Coxon[4], Alexa J. Halford[5] and Chigomezyo Ngwira[5,6]

[1]Department of Climate and Space Sciences and Engineering, University of Michigan, Ann Arbor, MI, United States, [2]United States Naval Research Laboratory, Washington, DC, United States, [3]Institute of Geophysics, National Autonomous University of Mexico, Mexico City, Mexico, [4]Department of Mathematics, Physics and Electrical Engineering, Northumbria University, Newcastle upon Tyne, United Kingdom, [5]Goddard Space Flight Center, Greenbelt, MD, United States, [6]Department of Physics, The Catholic University of America, Washington, DC, United States

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Editorial on the Research Topic
Driving towards a more diverse space physics research community - perspectives, initiatives, strategies, and actions

This Research Topic welcomed papers on diversity, equity, and inclusion (DEI) in the international space physics community. Demographics of the space physics research community have been documented by the American Geophysical Union[1] and the American Astronomical Society[2], both finding the memberships in these societies are strongly dominated by white men. While these demographics are beginning to slowly change thanks to targeted efforts by select programs, significant progress has not been achieved. The field of space physics needs ongoing, intentional interventions to become a community that more accurately reflects all of humanity.

In order to achieve and, more importantly, sustain a diverse environment where all members of the research community can thrive, regardless of race, gender, ethnicity, religious beliefs, or any other discerning factor, we must nurture an inclusive, welcoming and respectful research culture. There are innumerous aspects to the research environment that result in high attrition rates of minority researchers. This is a worldwide problem that is the responsibility of every member of the space physics research community to address. Deep rooted, systemic biases, both implicit and explicit, are present throughout the research

1 The American Geophysical Union membership demographics are reported in the annual ethics DEI report, found here: https://www.agu.org/Learn-About-AGU/About-AGU/Ethics/Annual-ethics-reports.

2 The American Astronomical Society demographics committee posts their survey reports here: https://aas.org/comms/demographics-committee.

field of space physics and can result in dramatically different experiences for minority researchers as compared to their majority counterparts. Longstanding systemic biases have led to differences in how groups are treated within a society, such as inequitable service expectations, and therefore tackling the Research Topic of structural equity is necessary to sustain diversity and inclusion within an organization or community.

This Research Topic, "*Driving Towards A More Diverse Space Physics Research Community: Perspectives, Initiatives, Strategies, and Actions*," was organized around several goals.

1. Review the current understanding of DEI in the scholarly literature, including best practices from our or other research communities and documentation of the problem of bias, exclusion and inequity impacting the space physics community around the world.
2. Document and evaluate past and present activities regarding DEI carried out by members of the international space physics research community in different environments and cultures, whether positive or negative in outcome.
3. Assemble suggestions for future actions that could be undertaken by space physicists in the area of DEI, at any level from local to global engagement.

Submissions were submitted from members of the space physics community that address opportunities offered by increasing diversity, equity, and inclusion from a variety of angles. The scope of the published articles encompasses those that conduct statistical or narrative descriptions of the state of the international space physics community and its present culture, including demographics, interpersonal interactions, and organizational standards. It also includes papers that describe policies, processes, interventions, and actions that have yielded—or could yield—improvement in one or more aspects of DEI for the space physics community. Some submissions were personal stories and advice derived from those anecdotes. In all, 19 papers were published, ranging from short Opinion articles to full-length Reviews. It is hoped that the data, findings, and recommendations from these articles will be useful to not only the space physics research community but also many others across science, technology, engineering, and mathematics (STEM) disciplines.

Two papers addressed the composition of the space physics research community. Demographics data for space physics and other STEM fields were compiled across a number of reports and analyzed by Bagenal, who found that the "pinch point" where diversity is hindered is at the high school and college stages. They also compile a large number of potential remedies to be taken by the research community, ranging from suggestions to federal agencies to actions that could be taken by individuals. Demographics data on a space physics conference series is provided by Jones Jr and Maute; an insightful conclusion they draw from their work is that the large effort of conducting equity and inclusion work needs to be properly acknowledged and rewarded in our community, including by funding agencies.

Several articles addressed ways to improve the diversity within the workforce. Gallagher Dunn et al. discuss the need for long-duration mentorship and research community involvement at the secondary school level to successfully overcome the "leaky pipeline" Research Topic so often noted at this critical educational stage. Lin et al. describe their student-led initiative to increase inclusion for Historically marginalized and Underrepresented Genders (HUG) in an engineering department (with a large space physics group) at a major research university. They describe the "chilly climate" for HUG students and the higher attrition rate that recorded in their surveys. They recommend several community-building actions, especially peer mentoring and informative workshops. Halford et al. discuss the "leaky pipeline" in which diversity of the workforce is reduced at each stage of schooling and career advancement. In order to combat this attrition, they argue for an emphasis on interdisciplinary science, better resources for stability and support of those in "soft money" positions, community-wide mentorship programs and training, and accountability for bad behavior, including better support for victims and stronger non-retaliation policies.

The specific practices within several large groups, centers, and teams were documented. The DEI initiatives of a new large-scale, multi-institutional space physics research project are described by Buxner et al. including an online repository of testimonials, career-path webinars, undergraduate research support, and a yearly summer school. Yalim et al. present diversity-building activities at their university, especially bringing local youth onto campus for short-term directed research experiences. The diversity efforts of a NASA-funded planetary mission are detailed by Curry; they focused on increasing the visibility and leadership opportunities for early career researchers within the team, eventually resulting in diverse leadership. They also strictly enforced an inclusive Rules of the Road that set a team culture toward cooperation, openness, and accessibility.

Several articles focused on nominations and hiring. Both Kee see et al. and Walach et al. consider the Research Topic of research community awards and prizes. A major recommendation from these two articles is this: take on the task of nominating your peers for awards. Another is that better demographics data is needed in order to truly assess the diversity of award nominees and winners. A third recommendation is that we need clear and transparent selection criteria and processes so that nominations can be written with the rubric in mind. Halford et al. directly address this last point, providing insights from a "Fellows" selection committee, presenting the selection criteria and evaluation process that they used. They also give suggestions for improving these criteria and processes, most notably that the process needs to start with the intentional establishment of an inclusive mindset for the committee. Burrell et al. further help with this Research Topic by providing recommendations for writing equitable letter of recommendation. They discuss the ways in which conscious and unconscious bias can influence the wording and structure of letters, and provide ways to mitigate the potential problems. Liemohn et al. provide a summary of their initiatives for equipping faculty to conduct equitable searches for new faculty, most notably taking "equity pauses" to intentionally center the broadly-based job-relevant criteria.

A few others focused on specific aspects of life within the research community. In Smith-Keiling and Keiling, recommendations are given for promoting inclusion at scientific conferences by steering personal interactions within the science program committee and local organizing committee, which sets the proper tone for the conference itself. Liemohn recapped DEI insights from serving as a journal editor in chief, recommending

that, when corresponding with colleagues, is it good to use singular they when gender is unknown and assume positive intent within the writing of others. Another key recommendation is to consider those with colorblindness when developing graphics; one in twelve men are red-green colorblind[3] (deuteranopia) and using traditional plotting features like the rainbow colorscale presents an accessibility concern. A new initiative for increasing the diversity of potential principal investigators for large mission concept proposals to NASA is the PI Launchpad Workshop Hamden et al. which seeks to equip researchers with the information, skills, and contacts needed to overcome the huge learning curve of this role.

Mental health within the space physics community is another of critical importance in this Research Topic. Nikoukar et al. raise awareness of this Research Topic, not only the prevailing stigma of discussing mental health but also the negative psychological impact of the COVID-19 pandemic. They offer several actions for addressing workplace burnout, isolation, and power imbalances, noting that some can be grassroots efforts while others must be implemented by institutional leadership. Turner and Smith advocate for community support of neurodivergent talent. Defined to include the many brainstates beyond "neurotypical," neurodiversity includes attention deficit hyperactivity disorder, autism, dyslexia, anxiety, and other long-term neurotypes. They urge us to adopt neurodiversity-affirming language that does not stigmatize or cast moral judgment on a mental state and to be inclusive of all people in the workplace through better awareness of physical comfort and sensory Research Topic. In addition to these two papers devoted to this Research Topic, Halford et al. includes a section on accessibility with many recommendations for accommodating mental, emotional, and physical needs in the workplace to allow all to fully participate.

While DEI action is often motivated by the benefits to the organization (the "business case" approach), Burt et al. challenge this mindset and present evidence that institutions can make more progress towards diversifying the STEM workforce by acknowledging and focusing on the ethical and social responsibilities of historical marginalization of certain groups. They make the argument that the business case could be, in some situations, harmful, placing a stressful expectation of enhanced productivity on Black, Latine, Indigenous, women, and other marginalized professionals. That is, support DEI efforts because it is the right thing to do in an world in which inequality still exists.

The summary above provides only a few of the many recommendations for increasing diversity, equity, and inclusion within the space physics research community. We strongly encourage you to read all of these papers; their richness and breadth is both informative and inspirational. In a survey of 132 alumni of the postdoctoral program at their institution, Burt et al. found that 87% were engaged in some form of DEI-related work in their current positions. Moreover, 31% had DEI as part of their job description. The early career contingent of our community is stepping up and changing our culture. We hope that these articles inspire you to make DEI an integral component of your approach to scholarly work. Our community is driving towards a better future and we hope that this Research Topic motivates further action to accelerate our progress.

3 One group claiming this statistic, and offering many tactics for better accessibility, is Colour Blind Awareness: https://www.colourblindawareness.org/.

Author contributions

ML: Conceptualization, Writing–original draft, Writing–review and editing. MJ: Conceptualization, Writing–review and editing. XB-C: Conceptualization, Writing–review and editing. JC: Conceptualization, Writing–review and editing. AH: Conceptualization, Writing–review and editing. CN: Conceptualization, Writing–review and editing.

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Conflict of interest

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