Recognition for All: A Way Forward to Enhance Diversity, Equity and Inclusion in Space Physics

M. Fraz Bashir,[1] Amy M. Keesee,[2,3] Seth G. Claudepierre,[4]
Michael D. Hartinger,[5] Elizabeth A. MacDonald,[6] and Allison Jaynes[7]

[1]*Department of Earth, Planetary and Space Sciences, UCLA, Los Angeles, CA, USA**
[2]*Department of Physics and Astronomy, University of New Hampshire, Durham, NH, USA*
[3]*Space Science Center, University of New Hampshire, Durham, NH, USA*
[4]*Department of Atmospheric and Oceanic Sciences, UCLA, Los Angeles, CA, USA*
[5]*Center for Space Plasma Physics, Space Science Institute, Boulder, CO, USA*
[6]*NASA Goddard Space Flight Center, Greenbelt, MD, USA*
[7]*Department of Physics Astronomy, University of Iowa, IA, USA*

ENDORSED BY

Alexa J. Halford, Ben L. Alterman, Charles Owolabi, Christina Cohen, Christina O. Lee, C. R. Gilly, Doga Ozturk, Erika Palmerio, Federico Gasperini, Geoff Reeves, Hui Zhang, James A. Klimchuk, Jerry Goldstein, John Leibacher, Katrina Bossert, Kristie Llera, Larry Paxton, Lindsay Goodwin, Lisa Wingate, Lynn B. Wilson III, Lynn Harvey, Matt Young, Mei-Ching Fok, Mike Liemohn, Misa Cowee, Naomi Maruyama, Niescja Turner, Paul Cassak, Ramon Lopez, Romina Nikoukar, Ryan McGranaghan, Sebastijan Mrak, Selvaraj Dharmalingam, Todd Anderson, Tom Berger, Victor Pinto, Yuri Shprits

1. PURPOSE OF THIS WHITE PAPER

This white paper aims to provide guidance to space physics and astrophysics communities to enhance Diversity, Equity, and Inclusion (DEI), especially for historically marginalized groups. These suggestions are based on the lessons learned (Keesee et al. 2022) from the continued and successful efforts of the Nomination Task Force (NTF) for Space Physics and Aeronomy (SPA) section of the American Geophysical Union (AGU) in the last five years. We present (1) data on the demographics of the SPA section highlighting different historically marginalized groups (2) an Overview of NTF's progress and success in significantly enhancing the nominations of historically marginalized groups for AGU honor and awards, (3) best practices and challenges faced by NTF, and (4) recommendations for continuing to improve the nomination process for different societies, agencies, universities, and other institutions.

* Corresponding Email: frazbashir@epss.ucla

2. INTRODUCTION

The STEM (science, technology, engineering, and mathematics) fields have been making strides to become more diverse and inclusive. Yet, a National Science Foundation report indicated that the Geosciences have one of the least diverse demographics National Science Foundation & National Center for Education Statistics (2017). The Space Physics and Aeronomy (SPA) section of the American Geophysical Union (AGU) is approximately 20% women. Space Physics falls in the Division of Plasma Physics within the American Physical Society (APS), which is one of the least diverse divisions within APS. Members of the Space Physics Research Community have been working towards improving diversity and inclusion. Liemohn et al. (2021) described "Increased Workforce Diversity" as one of the four topics that are emerging as "Instigators of Future Change in Magnetospheric Research."

Despite efforts to increase diversity and improve the climate, there have been many challenges. A news feature in *Physics* describes the pros and cons of scientific prizes, including the lack of diversity among prize winners not reflecting the diversity of the field. They also note the likelihood that multiple prizes are given to a few people instead of spreading the recognition (Popkin 2022). Unfortunately, there are many barriers that prevent scientists in historically marginalized groups from being considered for awards and honors at an equitable level across STEM fields (e.g. Symonds et al. 2006). Within AGU, between 2014-2018 when more complete demographic information was collected, women were not being nominated for AGU awards and honors at a rate proportional to their membership numbers at the related career stage (McFadden 2018). While we do not have quantitative data from prior years, this trend is likely to have existed for much longer given the total number of women and underrepresented individuals who became fellows prior to 2014.

In the 2021 Fellows nomination cycle, one AGU section chose not to select any nomination packages to forward to the Union Fellows committee due to the lack of diversity in their nomination submissions Harvey (2022). There have been numerous ensuing calls for action to improve this situation within AGU and other scientific professional societies. One barrier to improving the situation, particularly for the most eminent prizes such as the Nobel prize, is the lack of transparency and data on nominations Blunier (2022). While the AGU nomination process has more transparency, the data collection is limited to identity categories that are assumed, such as binary gender identity. In 2017, a grass-roots group within SPA noticed a lack of diversity in its Fellow nomination pool and created a Nomination Task Force (NTF) to support nomination packages for scientists that identify in historically marginalized groups. An initial report on the NTF was published in AGU's science news magazine, EoS (Jaynes et al. 2020). Now that the NTF has participated in five nomination cycles (with data available for four), we present results and lessons learned to share our best practices and success stories with a broad audience to help others build upon the work of the NTF and to adapt these practices to their own institutions and professional organizations. We emphasize that the goal of the NTF is not to change the criteria for selection of AGU Fellows and other honors and awards; it is to increase the nomination rate of scientists

from historically marginalized groups to a level that is more representative of the overall community membership.

3. IDENTIFICATION OF HISTORICALLY MARGINALIZED GROUPS FROM AGU SPA SECTION MEMBER DEMOGRAPHICS

We first present data on the demographics of the AGU SPA Section to identify different historically marginalized groups. We have categorized the data based on gender distributions for AGU SPA section in 2021 as a function of job location (Figure 1), career-level (Figure 2), and sub-section (Figure 3). The developed and developing countries are based on World Bank data. In Figure 1, we show that AGU SPA membership is largely (∼73% of the total membership) based in the United States with the second largest (∼23%) members from the institution located in developed countries. On the other hand, the membership from developing countries is very low (∼7%) and clearly represents a historically marginalized group. This brings to an important realization that the space physics community should understand the challenges and issues, and help to uplift the space physics community working in these institutions. The gender distributions in all three location-based categories are almost the same highlighting the gender imbalance in the space physics community with a female representation of less than 25%. There also exists another marginalized group that identifies as non-binary and transgender etc. SPA members in this group disclosed gender either as non-binary or as unknown/prefer not to answer category. This marginalized group makes up < 4% in the individual and overall category.
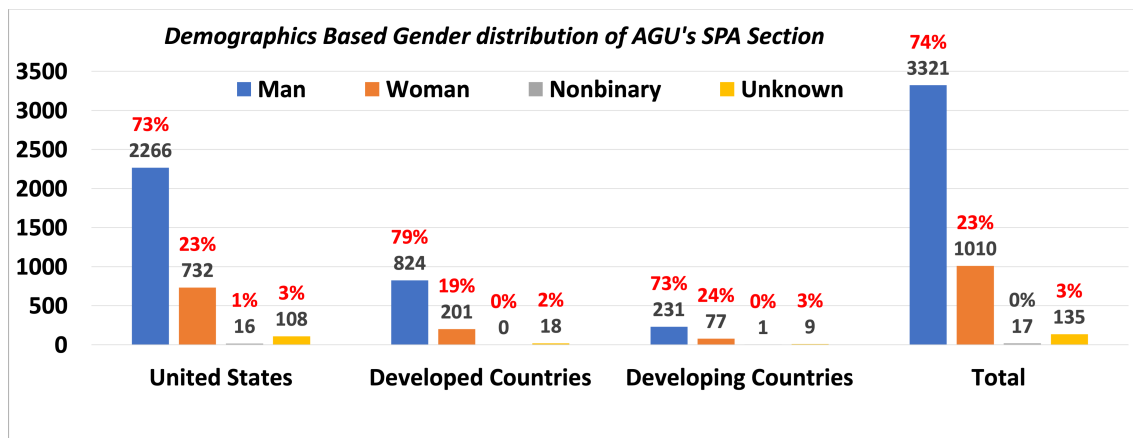

Figure 1. Gender distribution of the AGU SPA section as a function of location with percentage (red text) and number (black text) at the top of each category.

The data also provides insights into the gender-based distribution of career levels within SPA memberships. We note that the most significant space physics community within AGU is about equally distributed among early, experienced, and mid-career levels with about 30%, 28%, and 24% each of the total membership. The retired and student membership are pretty low with 8% and 6% of the total membership. There is still 4% of other career-

level membership which may represent responses from individuals from companies and/or exhibitors etc. The gender distribution establishes a clear trend of increasing the number of women and others (non-binary and unknown) with the career level i.e., minimum ($\sim 5\%$ and 0%, respectively) in the retired level and maximum at the student level (34% and 13%, respectively). The significant increase especially in women's representation in student and early career stages in the SPA community is a very good sign. However, we need more data and work to ensure the retention of historically marginalized groups beyond the early career levels.
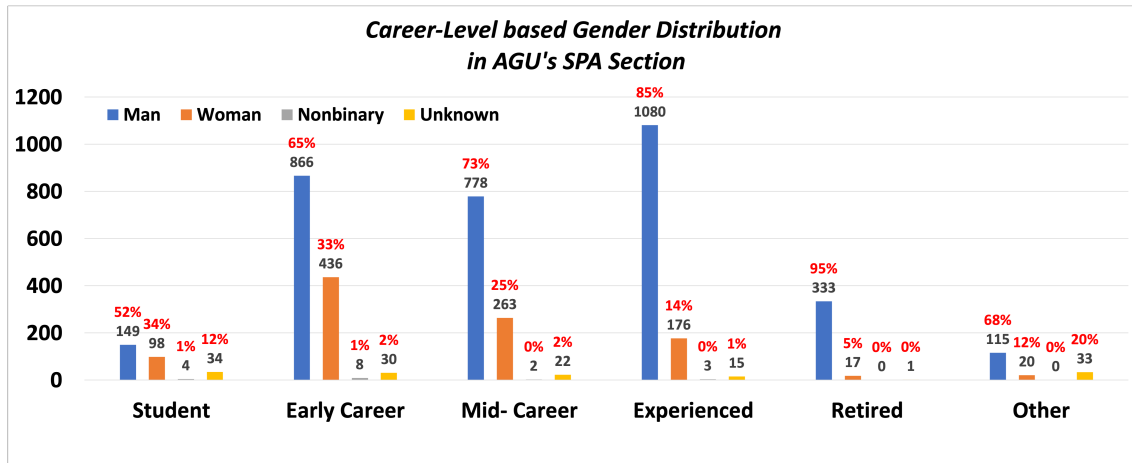

Figure 2. Gender distribution of the AGU SPA section as a function of career-level with Early, Mid, and Experienced levels are based on a number of years from Ph.D. i.e., $\leq 10, \leq 20$ and > 20 years, respectively. The percentage (red text) and number (black text) are shown at the top of each category.

It is important to have knowledge of membership distribution in these subsections to help maintain diversity in the recognition of scientists in these subsections (we will discuss it in the next section). The main SPA subsections are SM-Magnetosphere, SH-Solar and Heliosphere, and SA-Aeronomy). However, data here is categorized based on the selection of members to choose their primary membership in SM, SH, and SA and also SPA General (this category is the primary category without choosing any of the subsections SM, SH, and SA). The "other" category is for which SPA is the secondary interest of the members. So the SPA is the primary interest for 70% members and secondary interest for 30% of the total membership. It is not clear how redistribution of SPA general and Others to these subsections will change the numbers individually in SM, SH, and SA subsections. However, here we discuss only the SM, SH, and SA subsections where members have clearly identified themselves as their primary interest. We note that the SH subsection is the largest subsection with the highest representation of women and others (non-binary and unknown) and SM is the second largest in membership and women and others representation. SA subsection has the smallest SPA and women representations. Recently, a great concern has been raised by the SA community

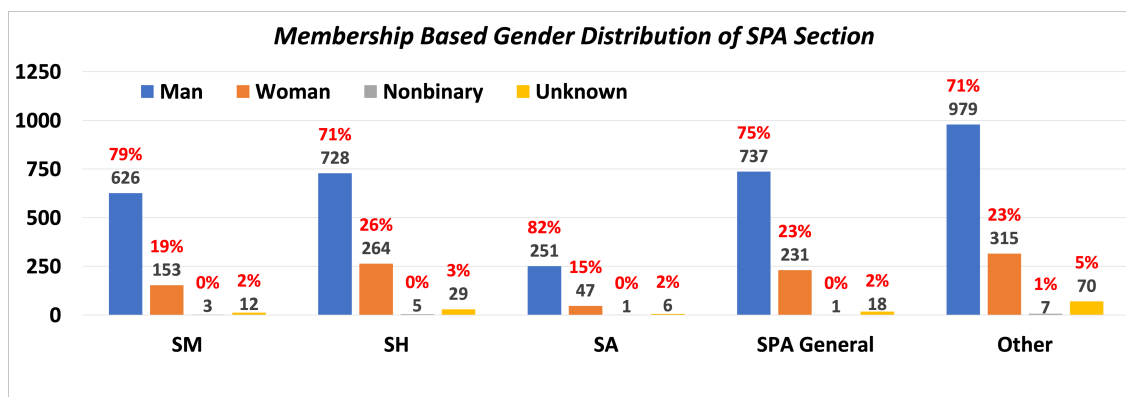about their under-represented recognition in AGU honors and awards (see next section for further details).

Figure 3. Gender distribution of AGU SPA section membership where members selected SPA as primary section (having the sub-section sub-sections: SM-Magnetosphere, SH-Solar and Heliosphere, SA-Aeronomy, SPA General). The SPA general category represents SPA members without the selection of a sub-section. The "Other" category represents SPA members who selected SPA section as their secondary section. The percentage (red text) and number (black text) are shown at top of the each category

The above discussion about the SPA demographics clearly demonstrates the existence of several historically marginalized groups based on their gender (women, non-binary and others) and their location (developing countries). SPA demographics also indicate that some sections are better represented than others in SPA membership based on self-reported section identification.

4. OVERVIEW OF AGU FELLOWS NOMINATION IN THE SPA SECTION FOR YEARS 2014-2021

The data for the AGU Fellows nominations for the SPA section for the years 2014-2021 is shown in Figure 4 which highlights the under-representation of women in AGU Fellow nominations with less than 25%. It is important to note that women's representation is significantly less in the years 2014-2017 with no nominations put forward for the years 2015-2017. However, the overall as well of women's nominations significantly increased after 2017. This is the time when NTF came into existence and significantly increased not only the overall nominations but also the women's nominations (see the next section for more details). It is also important to note that the international representation in AGU Fellows nominations for the SPA section varies between 13% to 33% over these years. However, we need more data to further investigate the under-representation of developing countries.

The AGU Fellows are mostly nominated from the experienced level category with very few nominations from the mid-career level. The total representation of membership, in the year 2021, in these two career level related to AGU Fellow awards are about 52% of the total membership (with men 42% and women 10%) and women representation in these
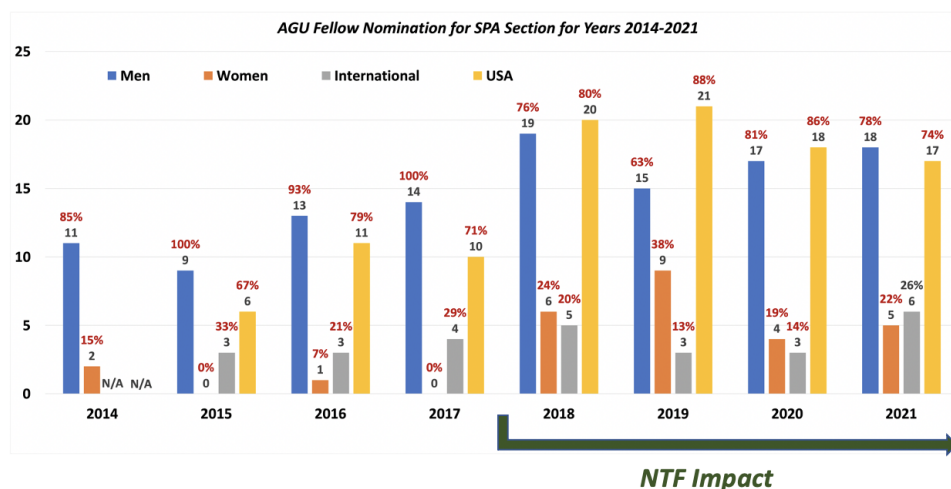
Figure 4. Overview of AGU Fellow nomination for SPA section based on gender and institute location (the USA and International). The percentage (red text) and number (black text) are shown at top of the each category. N/A represents the not available data for location-based nomination during the year 2014. The NTF influence started in the year 2018 and time overlapped with a significant increase in nominations time period (shown by the green arrow) overlapped with NTF efforts in the last 4 cycles. See the next figure for more detailed progress during these years.

both career levels is 25% and 14%, respectively (see Figure 2). The total nominations for AGU Fellows in the year 2021 (see Figure 4) were 0.6% of the total membership of mid and experienced career levels and obviously, it is even lesser for women nominations.

5. IMPACT OF NTF ON INCREASING NOMINATION OF THE HISTORICALLY MARGINALIZED GROUPS

The NTF, which was initially created to increase women's representation in AGU Fellow nominations, has made a significant impact on increasing the nominations of different historically marginalized groups as well as other AGU and non-AGU awards. As shown in Figure 4, the NTF has been involved in 24 Fellow Nominations, 29 nominations for other AGU awards, and 5 nominations for a non-AGU award. Several of these nominations resulted in awards. It is important to note that the NTF contributions in total Fellow nominations for the SPA section are very significant (see red text on orange bars in Figure 5) with an average of about 23% in the years 2018-2021.

While Fellow nomination packages are an important part of the NTF effort, we also work on other awards and honors (e.g., Joanne Simpson Medal, Macelwane Medal, SPA Scarf Award etc), and even some non-AGU awards to a lesser extent. The NTF created a tool to help find appropriate AGU awards and is publicly available at https://connect.agu.org/spa/committees/ntf/award-finder. Our work has also influenced the mindset of other decision processes, such as the selection of named lecturers at the AGU Fall Meeting. All of these results enhance and promote equity, diversity, and inclusion within the field. AGU has recently implemented the need for nomination canvassing committees similar to the NTF
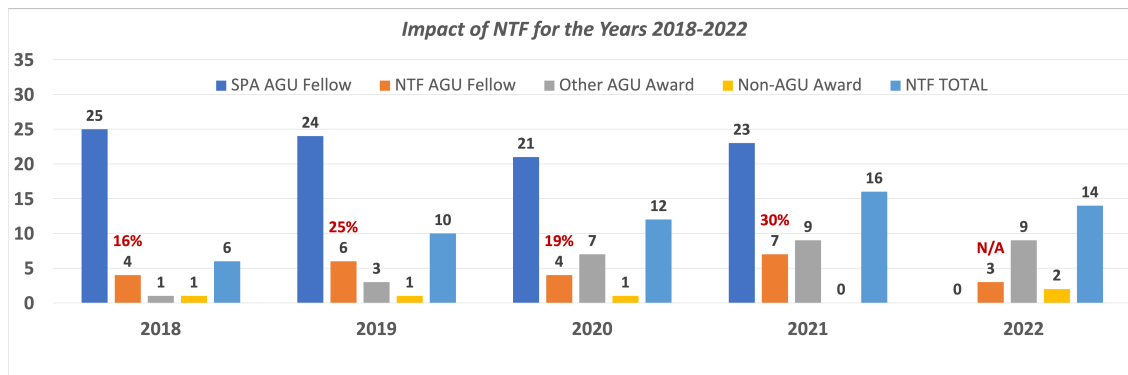
Figure 5. Overview of the NTF efforts in increasing the AGU honors and Awards since the year 2018. The grey color shows the total AGU Fellow nomination by NTF which can directly be compared to the total SPA fellow nominations (grey color in Figure 4 the comparison to the total SPA fellow nomination The percentage (red text) represents the contribution of NTF to the total SPA section nominations. N/A represents the not available data for AGU Fellow nominations during the year 2022.

for each of its sections, and the NTF provides continuous feedback to AGU on this process. The American Astronomical Society Solar Physics Division also has initiated an NTF as an official ad hoc committee with the help of SPA NTF members.

6. GUIDANCE FOR SPACE PHYSICS COMMUNITY THROUGH LESSONS LEARNED BY THE NTF

Nomination packages typically require in-depth volunteer work from a number of individuals close to the nominee but benefit from a coordinated team approach. This grass-roots, distributed approach divides the work of creating robust, winning nomination packages while considering privacy and a number of other sensitivities. Quality is increased with informal peer-to-peer review and crowd-sourcing at each step of the way. The group culture values transparency and teaches others how to do what was once privileged knowledge passed primarily among select senior members. This distributed approach scales and is transferable to other societies. Participating in the NTF is a valuable and unique opportunity to learn more about the AGU awards process and to help ensure that award nominations come from a wider and more representative fraction of SPA. Early-career scientists benefit from the opportunity to network with more senior colleagues on a regular basis. The NTF meets regularly throughout several months of the year on video teleconferences and in person at the AGU Fall Meeting, usually for a social meal. Additional communication happens among the team for each nomination package.

The NTF has had a number of discussions of best practices in general nomination writing as well as specific practices to improve AGU nominations, and have compiled many of these resources into one location at https://connect.agu.org/spa/committees/ntf/ntf-reading. A common debate is whether to inform the nominee of the nomination. While some people prefer to conduct the nomination in secret, the nominee can help with getting suggestions for nominators and providing updated bibliographies and curriculum vitae. Another debate

is whether to include the h-index, which has been shown to be biased Chapman et al. (2019). The NTF often suggests including the h-index if it's high, and the source of the index, as well as citation counts, should always be included. When working with the letter writers, it is helpful to ensure that they will use the full length allowed, that the secondary writers will each focus on the details of a specific topic to avoid duplicating each other with a summary provided by the lead nominator, and that they will use a common referencing to the bibliography. It is also helpful to ensure they're using appropriate language in their letters, such as using non-gendered descriptive words, avoiding using the first name, and using strong language (scientists are reluctant to use subjective qualifiers like groundbreaking, pioneering, and paradigm shift). Many of these recommendations came from the Fellows Committee which regularly communicates with NTF members through their presentations and feedback to provide tips to make a successful nomination package at the start of the NTF cycle (in November). NTF constantly updates its resources based on this feedback to make a good package a great successful package. All of the resources are freely available to the community as mentioned above. Several of these recommendations are described and implemented by the "Equitable Letters for Space Physics" resource Burrell et al. (2021). The NTF also provides guidance through the website https://connect.agu.org/spa/committees/ntf where we share our AGU Award finding tool, timeline, best practices, lessons learned, resources to compile winning nomination packages, a Code of Conduct, FAQ, and extra resources. Many of these are general enough for the space physics community to utilize and enhance DEI through the recognition of historically marginalized groups.

7. RECOMMENDATIONS

Based on the 5 years of NTF's continued efforts, progress and lesson learned, we want to provide a few recommendations to the space physics community:

1. The award selection process and related practices should be reviewed annually to ensure fairness and representation of historically marginalized groups.

2. Societies and Agencies should provide resources for collecting sensitive demographic information in an anonymized manner to identify several historically marginalized groups

3. NTF-like committees should be established in different work settings for identifying deserving historically marginalized groups and helping them with nomination packages, providing access to information about awards and resources.

4. Using your pronouns tells everyone that you are not going to assume their gender. It is an important move towards real inclusivity and creates a healthier, safe space for everyone in the workplace, wider society, and also in the space physics community.

5. There is an immense need for significant collective efforts to remove implicit biases within our field as understanding and addressing implicit bias help to promote diversity and equality.

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