INCLUSIVITY AND THE CULTURE OF PLANETARY SCIENCE: THE HOSTILE OBSTACLE COURSE. J. A. Rathbun[1], E. G. Rivera-Valentín[2], and S. Diniega[3], [1]Planetary Science Institute (Rathbun@psi.edu), [2]Lunar and Planetary Institute (USRA), [3]Jet Propulsion Laboratory, California Institute of Technology

Introduction: The April 2020 survey of Planetary Scientists, which was conducted by the Statistical Research Center of the American Institute of Physics (AIP) and funded by the American Astronomical Society (AAS)'s Division of Planetary Science (DPS) showed that the planetary science community lacks diversity along several axes [1-3]. Results show that members of racial and ethnic minority (URM) groups, particularly Black and Latinx groups, are severely underrepresented in planetary science [2]. Furthermore, there has been no improvement in representation for these groups in at least the past decade [3]. Representation of white women and LGBTQ+ scientists, while low, has improved substantially over the last decade [1].

Many efforts to increase diversity within other STEM fields have concentrated on recruitment [4-5]. Here, we focus on retention, inclusion, and equity, within the planetary science culture and community.

The presented work is intended for members of historically included groups in planetary science, such as those that are white, cis-gender, male, and heterosexual, that continue to make up the majority of the community. Members of historically excluded groups are well aware of the existing barriers and the actions necessary to address them.

Hostile Obstacle Course: When considering the decreasing fraction of underrepresented folks within STEM pursuits with increasing career level, the "leaky pipeline" visualization is often used. However, that framework implies that attrition of URM group members, white women, and members of other historically excluded groups is a passive process, and that all that is needed is to "patch up the holes" [6].

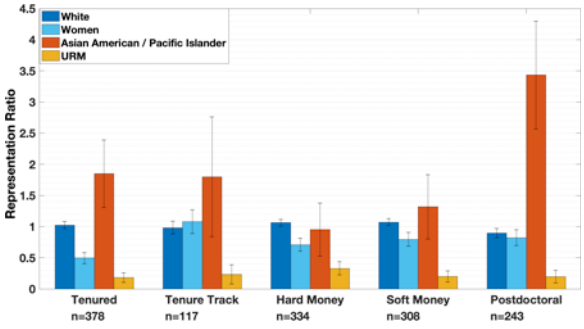

Figure 1: Planetary Science Demographics by job type. Data from [1]. All values have been ratioed to numbers in the national civilian labor force [3].

However, focus on "closing up holes" that drop people along our traditional career pathways distracts from structural and systemic problems that exist within our institutions that actively push people out of our community [6]. A better framework for understanding how and why members of underrepresented groups are underrepresented is a hostile obstacle course, as this metaphor captures more explicitly the "widely documented bias, harassment, discrimination and other exclusionary behaviors" that exists in STEM [6].

A 2021 NASEM workshop on *Addressing Diversity, Equity, Inclusion, and Anti-Racism in 21st Century STEMM Organizations* [7] "explored the ways in which systemic racism and other barriers impede STEMM careers for historically marginalized racial/ethnic groups." They point out that, while some BIPOC (Black, Indigenous, and other people of color) individuals manage to get through the barriers to participate in STEMM communities, they are often not allowed to take leading roles nor are they recognized for their contributions with the same rewards as white researchers [7]. Furthermore, their work is consistently undervalued [8].

Evidence of Barriers: After members of historically excluded groups become planetary scientists, they continue to lag behind planetary scientists with historically included identities in measures of success, such as involvement in spacecraft mission science teams [9]. For example, the percentage of women on spacecraft science teams has been stagnant at ~15% for the past 15 years despite women making up an increasing fraction of the planetary science community (up to 30% in 2020 [3]).

Based on the 2020 survey [1], women and members of URM groups are underrepresented in tenured faculty positions, women at approximately half the representation expected and URM scientists at only approximately one tenth of that expected (Figure 1). Tenured faculty positions are the most coveted, secure, and, often, prestigious positions for planetary scientists.

Using data provided by NASA publicly at the Planetary Science Advisory Council on 2021 June 14 [10], we calculated the Research and Analysis proposal selection rates for different racial groups (Figure 2). We found that selection rates for white scientists were consistently above the overall selection rate. Selection rates for members of URM groups have been

substantially and consistently lower than the overall selection rate: the average 7-year selection rate for white PIs was 22%, 19% for Asian American PIs, and 15% for URM PIs. In order to constrain the expected selection rates by race and ethnicity we used Monte Carlo methods to randomly select 2,103 proposals from 10,082 submitted proposals, which are the actual observed proposal statistics summed from 2014 to 2020. We then took the mean and standard deviation of the selection rate of each studied demographic group over the Monte Carlo ensemble, which consisted of 10,000 realizations. This method captures the potential variation of selection rates for the small number of proposals submitted by URM PIs. We find that the expected selection rate for URM PIs was 21% ± 2.4% (2-σ); therefore, the observed selection rate for URM PI-led proposals is far lower than expected.

Types of Barriers: Biases against BIPOC scientists and white women are well documented (see [11] for a discussion) and include assuming members of historically included groups are more competent and offering more resources to members of historically included groups (including money, observing time, and more). For example, 75 percent of white Americans show an implicit preference for white people over Black People [7]. Hostile climates including harassment, bullying, microagressions, and more, are also prevalent in STEM [7,11].

The culture of planetary science is rarely discussed publically. However, members of historically excluded groups (including BIPOC, white women, disabled scientists, and scientists from low socio-economic status background) are well aware of how the science culture differs from the culture in which they were raised [12].

Recommendations: Recommendations for improving inclusivity and equity in STEMM and academia can be found in many documents [2-5, 7, 11-14].

For individual planetary scientists, particularly members of historically included groups, we recommend to: (1) realize that gender- and color-blind approaches do not work [7]; (2) pay attention to the demographics of people you work with, make an effort to include, hear from, and value members of historically excluded groups; (3) learn how to intervene to help others in the obstacle course (for example, bystander intervention).

For NASA and other groups, we recommend: (1) make DEIA a valued part of how grants are awarded, such as making racial diversity as important a priority as institutional diversity when selecting teams, (2) continue to implement policies, such as Dual Anonymous Peer Review (DAPR) to mitigate biases within standard community processes, such as proposal and paper review, (3) punish harassers and bullies in the field, (4) involve and fund social scientists in creating policy.

References: [1] Porter, A. et al. (2020) AIP report https://dps.aas.org/sites/dps.aas.org/files/reports/2020/Results_from_the_2020_Survey_of_the_Planetary_Science_Workforce.pdf [2] Rathbun J. A. et al. (2021) *LPS LII,* #2094. [3] Rivera-Valentín E. G., et al. (2021) *LPS LII,* #2163. [4] Hill C., et al. (2010) *AAUW report. https://eric.ed.gov/?id=ED509653* [5] NASEM (2020) *Astronomy Survey* https://doi.org/10.17226/26141 [6] Berhe, A. A. et al. (2021) *Nat. Geosci.* https://doi.org/10.1038/s41561-021-00868-0 [7] NASEM (2021) Anti-Racism in STEMM doi: 10.17226/26294 [8] Hofstra, B. et al. (2020). *Proceedings of the National Academy of Sciences*, 117 (17), 9284–9291 [9] Rathbun, J.A., 2017, *Nat. Ast.,* **1,** id 0148 [10] https://science.nasa.gov/science-red/s3fs-public/atoms/files/07-Barbier-Demographics-061421.pdf [11] Marín-Spiotta, E. et al. (2020) *Adv. Geosci.* **53**, 117-127. [12] Diniega, S. et al. (2020) *DPS #52*, id 502.06 [13] Berhe, A. A. and Ghezzehei, T. A. (2020) *Eur J Soil Sci,* DOI: 10.1111/ejss.13078 [14] Nashville recommendations for Inclusive Astronomy (2015) https://tiki.aas.org/tiki-index.php?page=Inclusive_Astronomy_The_Nashville_Recommendations

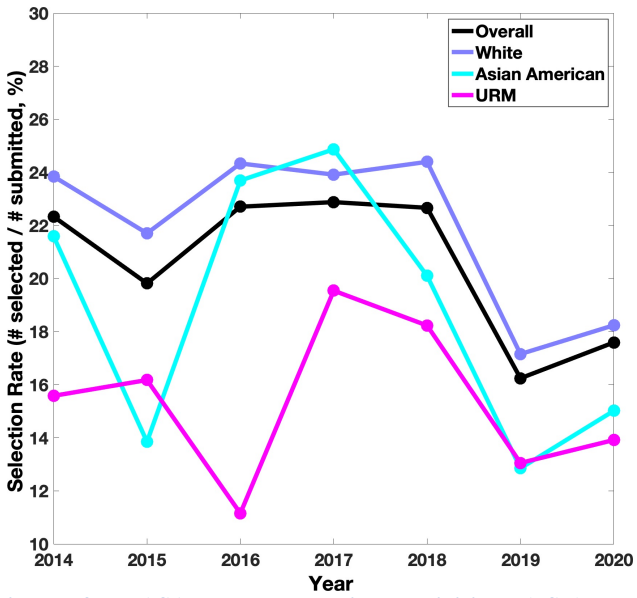

Figure 2: NASA planetary science division (PSD) research and analysis grant (ROSES) selection rates by racial/ethnic group.