

DEMOGRAPHICS BY RACE, ETHNICITY, AND GENDER OF PLANETARY SCIENCE. E. G. Rivera-Valentín¹, J. A. Rathbun²; ¹Lunar and Planetary Institute (USRA), ²Planetary Science Institute.

Introduction: Diversity initiatives have attempted to bring the science community to parity with the national population. Although some initiatives have been effective, not all have been inclusive of multiple axes of representation. For example, the geosciences have seen an increase in the representation of women doctoral graduates, rising from 30% in 2000 to 49% in 2018; however, no improvement has occurred for Black / African American researchers [1]. *This is not due to a lack of interest!* Both Black / African Americans and Latinx / Hispanics show interest in STEM comparable to White people (e.g., [2,3]). Rather, the current lack of representation is a manifestation of a system with a history of oppression.

In planetary science, previous workforce surveys showed that the demographics are not representative of the national population [4,5], with this lack of diversity magnified in NASA mission teams [6-8]. In preparation for the Planetary Science and Astrobiology Decadal Survey, the Division of Planetary Sciences (DPS) funded a workforce survey administered by the American Institute of Physics (AIP). Survey respondents included both DPS members and nonmembers. A summary of the survey results by the AIP is available [online](#). Additionally, demographic information, in particular race, ethnicity, and binary gender, are available through the NSF's National Center for Science and Engineering Statistics of Ph.D. recipients and NASA through the proposal submission system NSPIRES. Here we collate and compare data from these different surveys to constrain planetary science workforce demographics and identify trends in underrepresentation, focusing on race, ethnicity, and reported gender, as well as the intersection of these identities. Such trends can help motivate and inform future workforce initiatives; however, demographic studies should not be the only discussion point.

Methods: Demographic information was compared using the reported groups and based on the analysis presented in the report by NASA's Office of Diversity and Equal Opportunity [9]. Following their lead, we also compared demographic results to the National Civilian Labor Force (NCLF) for each respective year. Reported margin of error is to a 95% confidence level (i.e., 2- σ) and represents the survey's ability to predict the demographics of the overall field.

DPS-AIP Surveys: The 2011 planetary workforce survey did not include student respondents, while the 2020 survey did. To properly compare surveys, we show results in Fig. 1 from the 2020 survey for student

(SR) and non-student researchers (NSR) separately. Figure 1 presents the demographic data in what we term the representation ratio, which is the percent representation of the demographic in the field with respect to the percent of that demographic in the NCLF for the same year. As a result, a ratio of 1 indicates parity, a value > 1 indicates the demographic is represented above the national average, and a value < 1 indicates underrepresentation.

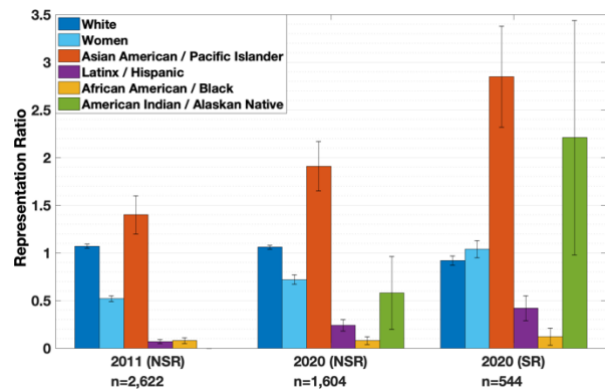


Figure 1: Representation ratio for the demographics surveyed in the 2011 and 2020 DPS-AIP workforce surveys for non-student researchers (NSR) and student researchers (SR).

In 2011, Black / African Americans and Latinx / Hispanics were underrepresented by about 90% each relative to the NCLF (i.e., a ratio of ~ 0.1). *No data was presented for American Indian / Alaskan Natives in the 2011 survey.* Currently, American Indian / Alaskan Natives are underrepresented by $42.3\% \pm 37.6\%$, Latinx/Hispanics by $76.3\% \pm 5.7\%$, and Black / African Americans by $91.6\% \pm 4.0\%$ with respect to the NCLF for NSR. There is a significant difference between the NSR and SR American Indian / Alaskan Native populations, suggesting some improvement. The change in representation of Latinx / Hispanics from 2011 to 2020 is $3.0\% \pm 1.0\%$, which may be continuing within the SR population. *Notably, no significant change has occurred for Black / African Americans between 2011 and 2020 ($0.1\% \pm 0.6\%$) and between the NSR and SR groups (0.9 ± 1.3).*

It is important to acknowledge that the Asian American / Pacific Islander demographic group is diverse and consists of people who trace their roots to many different countries across East and Southeast Asia, the Indian subcontinent, and Pacific islands. As such, implications on representation and barriers to inclusion are not appropriate. Future workforce surveys should disaggregate both Asian American / Pacific Islander and Latinx / Hispanic groups.

In 2011, women were underrepresented by $48.1\% \pm 3.4\%$. Currently, nonbinary NSR account for $0.7\% \pm 0.4\%$, men for $66.5\% \pm 2.3\%$, and women for $34.7\% \pm 2.5\%$ of planetary scientists; thus, women are currently underrepresented by $28\% \pm 5.2\%$. Over the past nine years the representation of women increased from $25\% \pm 1.7\%$ to $34.7\% \pm 2.5\%$. Notably, women make up $50.3\% \pm 4.3\%$ of the current student population. However, this improvement in representation may not have been equally shared by all women. In Figure 2, we show an intersectional perspective on the AIP-DPS 2020 workforce survey results compared against the national population in the US. As can be seen, Black, Latinx, and Indigenous women are represented far below the national population.

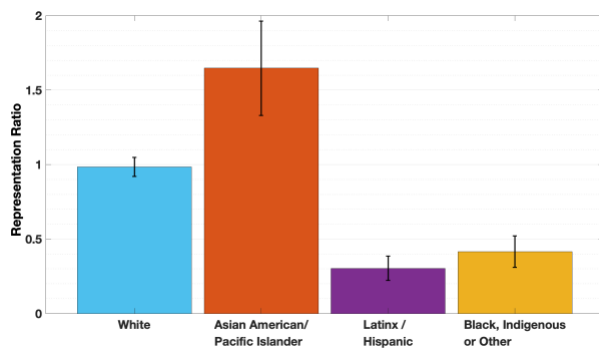


Figure 2: Representation ratio for women by race and ethnicity as reported in the DPS-AIP workforce survey. Color follows the coding from Figure 1. Due to privacy concerns, answers for Black, Indigenous, and Other not presented race/ethnicity women were aggregated. We note that national statistics are not available for nonbinary people.

NASA NSPIRES Data: Demographic information of proposers were collected by NSPIRES beginning in 2016. The data have been provided by NASA to the Planetary Advisory Committee and is available [online](#). Comparison of the AIP-DPS based race, ethnicity, and gender demographics and that of NASA NSPIRES shows that representation is similar within error. This provides confidence in the presented values. Of course, the NSPIRES survey had some 10% of respondents prefer not to answer demographic questions. Although this is accounted for in our error analysis, this demonstrates a potential weakness of the survey tool.

Physics and Geoscience Doctoral Graduates: Because the workforce surveys indicated that planetary scientists generally earned their degrees in physics or geoscience, we studied the demographics of doctoral graduates from those fields, specifically for women, Latinx / Hispanic, and Black / African Americans. In Fig. 3, we used weighted least squares fit to find the percent change over time.

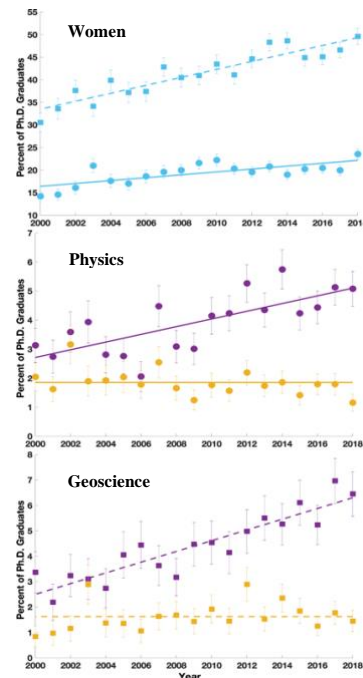


Figure 3: Percent representation of doctoral graduates for women (top) in physics (circles and solid line) and geoscience (squares and dashed line), and (bottom) Black / African American and Latinx / Hispanic (following the color coding from Fig. 1).

Since 2000, geosciences have seen an increase in the representation of women by $0.88\% \pm 0.18\%$ per year and in physics by $0.33\% \pm 0.15\%$. During the same time, Latinx / Hispanic representation in geology and physics has increased by $0.21\% \pm 0.05\%$ and $0.13\% \pm 0.06\%$. *No change has occurred for Black / African Americans in either field over the last 18 years* ($0.03\% \pm 0.04\%$). This is in contrast to the overall increase of Black / African American doctoral graduates in STEM ($0.09\% \pm 0.02\%$ per year).

Further underrepresentation occurs for women of color. Since 2000, Latinx / Hispanic women have accounted for $48.7\% \pm 4.3\%$ and $19.6\% \pm 2.9\%$ of the doctoral degrees earned by Latinx / Hispanics in geology and physics respectively. Black / African American women are underrepresented in both fields with respect to Black / African American men as they account for $23.3\% \pm 4.6\%$ and $34.3\% \pm 6.9\%$ of the doctoral degrees earned by Black / African Americans in geology and physics, respectively.

Representation trends identified in the AIP-DPS survey are corroborated by the NSF doctoral graduates data. In particular, the unchanging representation of Black / African American researchers in planetary science over the last decade is also seen for geoscience and physics doctoral graduates.

References: [1] Bernard, R.E. & Cooperdock, E.H.G. (2018). *Nat. Geos.*, 11, 292–295. [2] Crisp, G. & Nora, A. (2012). *White paper*. [3] Riegler-Crumb, C., et al. (2019). *Educational Researcher*, 48 (3) 133–144. [4] White, S. et al. (2011) <https://lasp.colorado.edu/home/mop/files/2015/08/Report.pdf>. [5] Hendrix, A. R. et al. (2020). *LPSC*, [id.2813](#). [6] Rathbun, J. A., et al. (2015) *DPS*, [id.312.01](#). [7] Rathbun, J. A., et al. (2016) *DPS*, [id.332.01](#). [8] Rathbun, J. A. (2017) *Nat. Astro.*, 1, 0148. [9] FY2018 MD-715 Report https://science.nasa.gov/science-pink/s3fs-public/atoms/files/2020-2024_Science.pdf