

A HISTORICALLY BLACK COLLEGE AND UNIVERSITY (HBCU) PILOT PROGRAM TO AID IN THE DIVERSIFICATION OF THE PLANETARY SCIENCE PIPELINE. Lynnae C. Quick¹, Marcus Alfred^{2,3}, Noah Petro¹, Orenthal J. Tucker¹, Caitlin Ahrens^{1,3,4}, Shawn D. Domagal-Goldman¹, Kierra A. Wilk^{1,5}, Amber V. Young¹, ¹NASA Goddard Space Flight Center, Lynnae.C.Quick@nasa.gov ²Howard University Department of Physics and Astronomy, maralfred@howard.edu ³Center for Research and Exploration in Space Science and Technology II (CRESST II), ⁴The University of Maryland-College Park, ⁵Brown University

Introduction: Recent studies show that the racial and ethnic diversity amongst those who have doctorates in the earth, atmospheric, and ocean sciences is extremely low. 86% of geoscience doctorates obtained between 1973 and 2016 were awarded to students who identified as White and non-Hispanic [1]. This lack of diversity is especially troubling, as a significant number of planetary scientists have traditionally obtained their Ph.Ds. in these fields [2]. Recent Division for Planetary Sciences (DPS) surveys reveal that less than 1% of Ph.D. level planetary scientists identify as Black or African American, making this group amongst the most underrepresented group in planetary science [3-6]. This is not because of a lack of interest [7-8], but rather because of a historical lack of opportunity to participate and a lack of equitable access, often as a result of colorblind diversity and inclusion efforts [2-3, 5-6, 9]. Due to their focus on axes of representation such as gender, career stage, etc., rather than race and ethnicity, colorblind diversity and inclusion efforts may lead to the creation of spaces where the voices and culture of the majority group dominates; this can serve to further isolate and exclude students who are members of underrepresented racial minority groups [10].

In the last decade, more than 33% of all African Americans with PhDs in STEM fields earned their undergraduate degrees from Historically Black Colleges and Universities (HBCUs), and over 40% of African Americans received either their B.S., Ph.D., or both, from an HBCU [9]. Owing to vast institutional support mechanisms such as access to mentors of the same race *and* gender, a culture that offers constant encouragement rather than actively seeking to “weed out” students in the pursuit of STEM degrees, and positive relationship building between faculty and students [11,16-19], a significant fraction of African American STEM students obtain their undergraduate degrees from HBCUs. As such, the absence of effective outreach to these institutions contributes to the low numbers of African Americans in the planetary science pipeline. The desire to diversify the field of planetary science, including efforts to ensure that proposal and mission teams are reflective of the society in which we live, necessitates purposeful and targeted partnerships and collaborations with HBCUs.

Pilot Program Plan: We have initiated a pilot program to introduce planetary science to

underrepresented minority students via the establishment of a formal relationship between NASA Goddard Space Flight Center’s (GSFC) Solar System Exploration Division (SSED) and the Howard University Department of Physics and Astronomy. In doing so we seek to assist in diversifying the planetary science pipeline by working with Howard University physics faculty to introduce students to planetary science as a potential graduate major, dissertation focus, and career field. Notably, Howard University is the fourth largest producer of science and engineering undergraduate degrees to black students in the nation, and the top producer of black STEM PhDs amongst HBCUs [9,11]. The overarching goals of this effort are:

Goal 1: Provide concrete opportunities for African American STEM students to obtain the necessary skills, techniques, and experiences to enter the planetary science pipeline

Goal 2: Establish a formal planetary science focus at Howard University through formal relationship-building and routine interactions between Howard University physics faculty and scientists from NASA Goddard’s Solar System Exploration Division.

Goal 3: Offer tangible support to minority-serving STEM organizations that expose African American students to planetary science as a potential major and career field.

Goal 1: Providing Opportunities for Students to Enter the Planetary Science Pipeline: With the overall objective of training African American physics students in planetary science research, we focus on selective recruiting of summer interns from Howard University to work with PI Quick and other SSED scientists to study the processes at work on the planets and moons in our solar system. Projects that interns will undertake include mapping and modeling the emplacement of geological features on the icy moons and dwarf planets, developing constraints for the detection of geological activity at these worlds by spacecraft, and modeling volatile cycles on Mercury, Mars, and the icy moons. Students will not only gain the skills and experience that are necessary for careers in planetary science, they will also discover how their extensive training in physics, including their strong mathematical and computational backgrounds, can be utilized to solve planetary science problems.

Goal 2: Establishing A Planetary Science Focus Through Relationship Building and On-Campus Interactions: The PI and SSED Collaborators will establish a regular planetary science presence in the Howard University Physics and Astronomy department through informal and formal relationship building with students and faculty. In doing so, we aim to introduce undergraduate and graduate physics majors to the field of planetary science through regular, on-campus interactions. Introducing geoscience concepts in spaces where there are high percentages of students from diverse backgrounds is one specific action that can be taken to help diversify the geoscience pipeline [7]. Interactions will include: (1) PI Quick's and other SSED scientist's on-campus participation in meetings of the Howard University Space Science Group on a biweekly basis. This group is led by Co-I Alfred and consists of approximately 30 undergraduate and graduate student physics majors with interests in pursuing careers in astronomy and related fields (2) inviting one Washington, DC-area planetary scientist to give a special colloquium each semester (3) establishing a regular planetary science journal club.

Past studies have shown that college introductory courses are important deciding factors when it comes to students' interests in pursuing geoscience degrees [13]. Hence, the development of an introductory planetary science journal club at Howard University would be a simple, yet effective measure that could inspire students to pursue graduate degrees in planetary science. Journal Club meetings and Colloquia will be presented in a hybrid format so that students from other HBCUs can attend, thus serving to introduce a broader swath of underrepresented minority students to planetary science and available mentoring from Howard University faculty and SSED scientists. These students may in turn be recruited to complete their PhDs in physics at Howard University with a planetary science focus, utilizing SSED scientists as their research mentors.

Goal 3: Support for Minority-Serving STEM Organizations: Past studies have shown that connecting underrepresented minority students to organizations that focus on minorities in geoscience disciplines can be crucial for their entrance into geoscience fields [13]. To ensure that the broadest swath of African American students is introduced to the field of planetary science, this Early Career Award supports the PI's time co-chairing the National Society of Black Physicists' (NSBP) Earth and Planetary Systems Sciences (EPSS) section and serving on the NSBP Conference Planning Committee. After several years of low-activity, NSBP's EPSS section is currently being revamped. Assisted by a new partnership with the DPS

[14-15], the NSBP EPSS section represents a critical avenue by which African American students are introduced to research and careers in planetary science.

The annual NSBP Conference is the largest academic meeting of minority physicists in the United States. As such, it is heavily attended by students from HBCUs and other Minority Serving Institutions (MSIs) for whom planetary science as a research focus and career field may be largely unknown [12]. For this reason, it is critical that Howard University physics students present the results of their summer research to peers annually at the NSBP Conference and similar meetings. To facilitate student exposure to the wider planetary science community, while also exposing as many underrepresented minority students as possible to planetary science as a potential research focus and career field, this Early Career Award supports travel for GSFC planetary science interns from Howard University to present their research at one planetary science conference (e.g., LPSC, DPS, etc.) and one technical conference that supports underrepresented minorities in STEM such as NSBP, the National Association of Black Geoscientists (NABG), etc., each year.

We will discuss the progress we've made thus far and our plans for the next few years to achieve these goals.

References: [1] Bernard, R. E., and Cooperdock, E. H. G. (2018) *Nat. Geosci.*, 11, 292-295. [2] Hendrix, A. R., and Rathbun, J. A. (2021) *Bull. Am. Astron. Soc.*, 53, 473. [3] Rathbun, J. A. et al (2018) 49th LPSC, Abstract #2268. [4] Rathbun, J. A. et al (2019) EPSC-DPS Joint Meeting 13, Abstract #EPSC-DPS2019-661-1. [5] Rivera Valentín, E. G. et al (2021a) 52nd LPSC, Abstract #2163. [6] Rivera Valentín, E. G. et al (2021b) *Bull. Am. Astron. Soc.*, 53, 443. [7] O'Connell, S. et al (2017). *GSA Today* 27, 76-77. [8] Riegle-Crumb, C. et al (2019). *Educ. Res.* 48, 133-134. [9] Upton, R., and Tannenbaum, C. (2014). *AIR*, 3094b, 1-11. [10] Santana, L. M., and Singh (2022) *Proc. of Phys. Ed. Res. Conf.*, 419-424. [11] Gasman, M. and Nguyen, T.-H. (2014). *Tex. Educ. Rev.*, 2, 75-89. [12] Quick, L. C. et al (2021). 52nd LPSC, Abstract #2653. [13] Stokes, P.J. et al (2015) *J. Geosci. Educ.*, 63, 250-263. [14] Mainzer, A. (2021) DPS NSBP 2021 Partnership Memo, https://dps.aas.org/leadership/nsbp_partnership [15] Brooks, S. M. et al (2022). 2022LPICo2679, Abstract #2066. [16] Allen, W. R. (1992) *Harv. Educ. Rev.*, 62, 26-44. [17] Allen, W. R. and Jewell, J. O. (2002). *Rev. High. Ed.*, 25, 241-261. [18] Perna, L. et al (2009) *Res. High. Educ.*, 50, 1-23. [19] Jett, C. C. (2011) *J. Afr. Am. Studies*. 17, 189-205.