

NONBINARY SYSTEMS: GENDER-INCLUSIVE STUDY METHODS IN PLANETARY SCIENCE. B. E. Strauss^{1,2}, K. C. Rasmussen³, E. R. Maier⁴, S. R. Borges⁵, M. Durbin⁶, A. Erena⁷, T. Faridani⁸, J. A. Grier⁹, T. O’Neill¹⁰, C. Olsen¹¹, L. Riesbeck¹², E. G. Rivera-Valentín¹³, E. L. Sneed¹⁴, A. Wallach¹⁵, D. Waller¹⁶, and V. Zamloot¹⁷, ¹Materials Science and Engineering Division, National Institute of Standards and Technology, 100 Bureau Drive, Gaithersburg, MD 20899, ²NASA Goddard Space Flight Center, Greenbelt, MD 20771 (beck.strauss@nasa.gov), ³University of Michigan, ⁴University of Arizona, ⁵Northern Arizona University, ⁶University of Washington, ⁷Smith College, ⁸University of California, Los Angeles, ⁹Planetary Science Institute, ¹⁰University of Virginia, ¹¹Rutgers University, ¹²George Washington University, ¹³Lunar and Planetary Institute (USRA), ¹⁴Penn State University, ¹⁵Boston University, ¹⁶Johns Hopkins University, ¹⁷City of Hope.

Introduction: Gender equity is one of the biggest issues facing the field of planetary science, and there is broad interest in addressing gender disparities within STEM disciplines. Many gender-related initiatives and studies of these topics have been led by professional physical scientists with little to no background or training in sociology, gender studies, and transgender studies. As a result, they tend to adopt a normative view of gender as a binary choice of ‘male’ or ‘female’, leaving planetary scientists whose genders do not fit within that model out of such research entirely. Reductive frameworks of gender and an overemphasis on quantification as an indicator of gendered phenomena are harmful to people of marginalized genders, especially those who live at the intersections of multiple axes of marginalization such as race, disability, and socioeconomic status. In order for the planetary science community to best serve its marginalized members, a new paradigm must be established.

We aim to address the future of gender equity and the inclusion of nonbinary and transgender people in planetary science and related fields by recommending better survey practices and institutional policies based on a more complex and profound approach to gender [1], [2].

Definitions: Language surrounding gender identity is continually evolving and rarely universally agreed upon by those it purports to describe. In this work, we use ‘nonbinary’ as an umbrella term for all genders not represented by the categories of ‘male’ or ‘female’. Not everyone whose gender falls under this definition uses the term ‘nonbinary’ to describe themselves.

Problematic Approaches: Recent studies attempting to evaluate and address gender disparities within planetary science and related fields have focused on topics ranging from the impact of gender on career-related metrics to social dynamics and harassment in professional settings. We have identified four major concerns common to many of the analyses presented in studies of gender equity in space science.

1. *Gender as observable.* Almost all of these studies, either explicitly or implicitly, rely on gender information acquired by means other than participant self-identification. These methods may include the

assignment of binary gender based on first names, based on either the authors’ perceptions or automated methods; inferring gender from public records like photos or articles including third-person gendered pronouns; or obtaining gender data from volunteer data collectors’ reports of subjects’ perceived gender in real time. Most simply remove data points with indeterminate gender identities. These methods result in misgendering and erasure, especially for nonbinary people, who are either misclassified or discarded. Further, automated systems often use U.S.- or Europe-based name databases and discard all ‘anomalies’, making their datasets disproportionately white. Experiences of misgendering and erasure have real psychological and professional consequences for transgender, nonbinary, and gender non-conforming individuals [3].

2. *Gender as discrete.* A closely related corollary to the above is that gender in these works is always treated as a set of discrete categories, which are presumed to be stable and coherent across populations, within individuals, and over time. Most employ the male/female binary as a matter of course, while others that do not require gender to be strictly binary still require that it be discretizable, e.g., through the selection of one of a limited number of options in surveys. Such frameworks reduce members of a category to interchangeable data points, which loses nuance and in turn denies people authority over how they are represented.

3. *Gender as statistic.* Several studies include disclaimer statements to the effect of: “While we recognize that gender is not binary, we do not include nonbinary people in our analysis due to lack of statistical significance.” These methods make statistical significance the determining factor in who matters, reducing the work of inclusion to mere quantification and failing to describe the deep complexity of gender and the experiences of people navigating it within planetary science. Additionally, such complexities cannot be properly understood without considering race, dis/ability, and other axes of marginalization [4]–[6]. They are also, in fact, incorrect; recent surveys have shown that between 0.5% and 13% of space scientists self-identify as nonbinary [1]. To dismiss these scientists as statistically insignificant is to be wrong.

4. *Gender as inconsequential.* Many gender equity efforts in planetary science are named for and focus on the experiences of women. However, the primary subjects and beneficiaries of such efforts have typically been limited to cisgender, white, heterosexual, abled women. Several expand their definition of scope to groupings like “women and nonbinary people” or “women+,” terms that inadvertently situate nonbinary people as a subcategory of women and thereby dismiss them as ‘basically women’ or ‘women lite.’ Related phrases like “female and female-identifying people” further compound this effect by attempting to separate transgender women from cisgender women and thereby incorrectly implying that they are not women. Even when such ostensibly inclusive language is used, these spaces tend to center cisgender women while ostracizing, and ultimately reinforcing the marginalization of, the people that they purport to include.

Recommended Best Practices: We recognize that gender equity efforts and projects in planetary science come from a genuine desire to bring about positive changes within our fields. We therefore make the following recommendations:

1. *Do not gather gender data through any means other than voluntary self-identification.* Do not use automated gender classification methods. Journals and funding agencies should prioritize gender equity initiatives that use the best practices developed by people of marginalized genders. Surveys *must* provide write-in fields and give respondents the ability to specify that they prefer not to disclose this information, or to refuse to answer the question entirely.

2. *Employ or consult trained social scientists when studying marginalized people in earth and space science.* The field of gender studies has existed for decades, and disciplines related to planetary science have been working to improve gender equity for years – it is not necessary for planetary scientists to reinvent the wheel. Studies of marginalized people in planetary science must incorporate funded support for interdisciplinary collaboration between physical and social scientists, particularly by providing funding to experts in these fields.

3. *Shift focus from women to people of marginalized genders.* Gender equity requires the adoption of a more complex model of gender than has historically been employed by equity initiatives. Consider the names of events, spaces, groups, and organizations, as well as descriptive language used to indicate who is welcome, and then go beyond language to ensure that the people you purport to include are genuinely included.

4. *The only thing that will bring about change is action.* Do not let suggestions, conversations, or plati-

tudes be the extent of your work toward equity and justice in planetary science. Our field must prioritize the voices and needs of the most marginalized people in our communities while taking tangible steps toward dismantling unjust systems and materially supporting those most harmed by those systems.

References: [1] Strauss B. E. et al. (2020) *Planet. Sci. Astrobio. Decadal Survey*, 8pp. [2] Rasmussen K. C. et al. (2019) *Decadal Survey Astron. Astrophys.*, 15pp. [3] Cech E. and Pham M. (2017) *Soc. Sci.*, 6. [4] Crenshaw K. (1989) *Univ. Chicago Legam Forum*, 1989, 271–282. [5] Crenshaw K. (1991) *Stanford Law Rev.*, 43, 1241–1299. [6] Combahee River Collective (1977) *Kitchen Table Women of Color Press*, 21pp.