Intersectionality and Physics Identity: A Case Study of Black Women From Different Nationalities

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In order to take steps toward making the physics field more equitable and inclusive for Black students, we focus our efforts in the study of the intersections of physics and racial identity. Through understanding common patterns of experience, we can begin to identify how Black physicists negotiate their physics identities in conjunction with their racial and ethnic backgrounds, and how they are impacted by structural and systemic factors. In ongoing work, we have developed an operationalized framework and methodology to examine the intersections of racialized identity and physics identity. Because Black physicists are not a monolithic group and can have very differentiated experiences depending on other identities, we conduct a case study to examine two physicists who are Black women from different countries, the U.S. and Kenya. Through the analysis of their interviews, we identify similarities and differences in the ways that each woman experiences physics, as well as how they view and frame these experiences in relation to their other identities. We outline common barriers that these women face and the different mechanisms they use for addressing them, and discuss the varied role of race in physics identity for each of them.

I. INTRODUCTION

Studies show that the culture of many STEM disciplines are unwelcoming and unhealthy for Black and Brown students [1]. Participating in these fields can cause physiological and psychological stresses due to tensions between the culture of the discipline and students' cultural and ethnic backgrounds [1]. In order to combat these challenges, we must develop deeper understandings of how these students identify with these disciplines. Given that Black students have some of the lowest participation and retention rates in physics, our work focuses on understanding how racial identity and physics identity are developed, negotiated, and challenged in the experiences of Black physicists. In this work, we use an intersectional lens to examine our assumptions about Black racial identity to create a more nuanced view of identity. Because there are many types of Black people who might have several intersecting identities, it is necessary to understand how other intersecting identities impact how one negotiates their Black and physics identities. This paper demonstrates the importance of having an intersectional lens when conducting identity studies by presenting a case study of two Black women who are physicists, one from the U.S. and one from Kenya. We use this analysis to critically examine the framing and methodology of our research with an attention to the ways we might be defining racial identity, specifically Black identity, from an American lens.

Our prior work focused on developing an operationalized framework to analyze narrative interviews, which we use in this study [2]. This framework is comprised of constructs that were pulled from models of racialized identity [3] and physics identity [4]. We use these constructs to code interviews with Black and white participants who are pursuing physics degrees and careers in order to show the differences in the factors that influence physics identity for the two groups.

From the coded data, we are beginning analysis around the systemic, structural, and ideological facets of physics culture that impact Black physicists in their pursuit of the field. With a goal to complicate how we represent who Black physicists are, here we outline how we can move away from monolithic representations of Blackness. The sections in this paper summarize our previous work theoretically connecting racial identity and physics identity and incorporate an analysis of how the framing, methods, and data are embedded in American definitions of Blackness. We will then discuss some ways that we can reframe this analysis and shift our methodology to better attend to differences in the experiences of Black physicists across the diaspora.

II. INTERSECTIONALITY AND PHYSICS IDENTITY

Intersectionality is a construct coined by Kimberle Crenshaw that stresses the importance of considering intersecting social identities when examining the impacts of systems of oppression [5]. Intersectional studies have been taken up in several fields [6]. Crenshaw used Intersectionality to express the importance of understanding the unique experiences of Black women. We take this up in our work by comparing the experiences of two Black women who have different national identities. Using our framework for critical physics identity, we examine how our constructs show up differently for these women based on their different intersecting identities. The works drawn upon for this research were all conducted through an American lens, and there are studies that show that a focus on race is an American societal ideology. Mary C Waters's *Black Identities: West Immigrant Dreams and American Realities* [7], describes the reasons why racism may not be the most impactful form of oppression in the eyes of Caribbean Black folks. Because of such findings, we can

hypothesize that racial identity differently impacts how non-American Black physicists identify with physics. We now identify a tension in our previous work where we need to either be more specific when we say “Black physicists” or identify and be explicit about the ways that our analysis differs when applied to Black physicists who are not American.

In this work, we consider a sociocultural perspective of identity and we use a lens of identity that stresses the importance of considering one’s environment and its impact on identity development [8]. Our framework for identity employs constructs from Hazari et al.’s physics identity framework [4] and Nasir’s racialized identity resources framework [3] in order to consider the impacts of structural resources that can impact one’s physics identity. The physics identity constructs includes: recognition from others as a good physics student, interest in physics content, competence, defined as the ability to understand physics content; and performance, defined as the ability to perform required tasks. The racialized identity framework has three broad resource constructs: ideational (ideas about oneself and one’s relationship to and place in a practice), material (the ways physical environment, its organization and the artifacts in it support one’s sense of connection to a practice), and relational (the way in which positive relationships with others in the context can increase one’s connection to a practice). We use these constructs to broaden the focus of physics identity to include the impacts of structures around them. In order to “operationalize” these constructs for use in our analysis, we make the racialized identity resource definitions physics specific and slightly change some of the physics identity constructs as well, with use of more specific subcodes. In accordance with [9], we also use some broadly defined subcodes across several constructs, like positive and negative, which we define as encouraging or discouraging participation in the physics, as well as internal and external, which we define as coming from the participant and coming from others. For more details on our operationalized framework and how we have used it, refer to our ongoing and prior work [2,10].

A. Methods & Context

Drawing from prior studies, we define a “physicist” as being someone close to or already having received a bachelor’s degree in physics. Because we collect data from who we are already considering to be physicists, we work with the assumption that our participants have some form of physics identity. We then use our methodology, that is centered on the use of personal stories, or narratives of physicists, to identify important aspects of their experiences that mold their physics identities. We have a sample of interviews from 10 Black men and women physicists that we are using for ongoing studies. Our semi-structured interview protocol was designed to elicit stories and ideologies from participants about their experiences while pursuing a career in physics. Some questions include: “How did you end up in physics?”, “Can you describe

a “typical” physicist?”, and “What difficulties have you faced pursuing the field?”. It is also important to note that the first author, a Black woman physicist, was the person who interviewed each participant, and it is likely that this impacted the types of things participants felt comfortable sharing.

In order to examine the ways that American Blackness plays a role in how we have been analyzing interviews in our work, we conduct an analysis on the interviews of an African American woman and a Kenyan woman from our sample. Cara is an African American woman with a Bachelor’s degree in physics, Master’s degree in physics teaching, and a PhD in Education, who is now working professionally as a physics education researcher and administrator at an R1 institution. Tammy is a Kenyan woman who obtained her undergraduate degree in physics in Kenya and is now pursuing a PhD in physics at a research University in the U.S.. Through the examination of the language and content of stories told by Cara and Tammy, we are able to use the operationalized constructs to code their interviews in order to highlight the complex structures in negotiation in the narratives that Cara and Tammy tell. The next section will outline themes from these two interviews that indicate the differences between the ways that they negotiate their physics identity and Black identity.

III. DIFFERENT VIEWS OF BLACKNESS

The analysis of Tammy’s and Cara’s stories brought out many interesting themes. There are similarities and differences in the ways that both talk about their Black identities and their experiences pursuing physics. This section outlines two themes from the analysis: their different views on race, and their similar experiences facing barriers. The differences in the narratives told by Cara and Tammy echo themes from work conducted on Non-American Black identity [11]. There were interesting differences in the ways that race came up in Tammy and Cara’s interviews. Tammy did not openly talk about how her race impacted her experience until explicitly asked. When asked about her struggles in the field, she brought up issues with adjusting to American culture, issues with her Kenyan accent, and the struggles she has had as a woman in the field. In a quote from her response to this question below, Tammy discusses negative relational resources when talking about her peers not accepting her at first.

“So coming to America, adjusting to the way of life and everything was a little challenging. I would say being- I would say being a woman in physics and like working with your peers, for them to accept what you’re doing and probably gaining the confidence from your peers was a little bit challenging for me. Initially it was not outright dismissive, but kind of people don’t have confidence in you until they’re quite sure or they see something that tells them oh, well, she can be able to do that or something like that.”

Tammy mentions her peers not being confident in her abilities, and attributes this to her identity as a woman, while not mentioning her race at all. However, Cara brought up her

Black identity on her own when answering a question about how participating in physics has impacted her life. She discussed positive material and relational resources when discussing how she has found spaces for women of color in STEM at specific conference, and made friends who can relate to her experiences. When discussing how being a physicist has impacted her social life and friend circles, she states:

“Like for example there are very few Black women in physics, we know that, so really soon when I find out that there’s a Black woman in physics— like I went to a conference for women of color in STEM and there were three of us who had physics backgrounds, and we just like— we became the best of friends like immediately, you know, and stayed in touch and continue to support each other in all kinds of stuff, even when I miss my physics friend, okay, so like even in health we’re like supporting each other because there’s just some... there’s so many things that you share being a part of that minority group of Black women in physics.”

It is evident from Cara’s comments that she intentionally looks to spaces where she can connect with other Black women in physics, and highly values those connections. The resources she draws on for support are specifically racialized for her in a way that was not brought up in Tammy’s interview. We see that Tammy has a different framing than Cara when asked about how her race has influenced her participation in physics. She discusses some negative external recognition and positive internal recognition when she describes how colleagues react to her in professional spaces:

“I would say like sometimes when I go to give a presentation or I show up somewhere and I would say when like my name is called to give a presentation, you can tell, I mean it’s human, you can tell from the faces that this is not, I mean it’s like we didn’t expect you. You can easily tell. But initially yes, it used to affect me. Initially it used to affect me but as I kept progressing and I thought this is what I’m doing and this is what I like to do and I mean I’m passionate about it, so I won’t let that affect me because it’s not basically my problem, it’s the other person’s problem.”

Tammy acknowledges that race plays a role in the ways other physicists react to her in certain professional spaces, but she has been able to cope with this negative recognition and shift it to positive internal recognition in order to push through. Her language suggests that this struggle is something that is in the past for her, where Cara frames the struggle as continuous when discussing how her friends of color continue to support her. Cara’s response to this same question about how race impacts her participation in physics describes internal ideational resources about what she values in physics when she discusses how she is differently motivated:

“Yes, [my race] impacts the way I participate in physics because my motivation has been very different than I think many other people in physics. I mean I’m not as familiar with the literature on kind of... motivations in general for women, or motivations for ethnic minorities and racial minorities... So for me it’s like yes I’m interested in physics, but... I don’t want to do physics for the sake of physics.”

Her feelings of not wanting to do physics “for the sake of physics” indicates non- physics content interest that aligns with studies that show American women and students of color in STEM often desire their work to have a social impact [12]. Race and racism defines how Cara participates in physics, where in Tammy’s case, race and racism is something she must adjust to and move on from. The differences in the language used by Cara and Tammy show that although these women share black and woman identities, they have nuanced differences in their views on how these identities have impacted their experiences in physics.

IV. SIMILAR BARRIERS

While we see these interesting differences in how Cara and Tammy view the role of race in their experiences, we also interesting similarities in their stories. Both women talk about relational resources from mentors being important pillars of support on their paths, struggles with belonging in the field, people assuming they are not physicists, and not seeing themselves as physicists at all times. Most notably, there is a theme of a resource that functioned as a physical barrier to their participation in physics that they had to overcome by some other means. An example of this happening to Cara is when she discusses an undergraduate advisor who tried to prevent her from taking a calculus-based physics course:

“But that professor would not sign off for me to take calculus based physics because he said it would be too hard for me, and he put me in algebra based physics instead. Me still being in my teenage rebellious stage, I was like... I was still a bit rebellious and I wanted to take the class, so I forged his signature on the memo sheet and took the calculus based physics class and aced it, and I was like, well, I really like physics, so I kept taking more physics classes. I was loving chemistry at the same time.”

In order to get past this barrier to her interest in physics, Cara showed positive internal recognition when going behind the back of her advisor to get into the course anyway. Similarly, Tammy talks about having to get around a structure in Kenya that disqualified her from participating in physics:

“So when I was in high school, in Kenya in high school you get selected to do courses like sciences depending on your strengths. So at this point we had to do an exam and if you score highly in that exam then you get selected to do physics. So when I did the exam I didn’t pass, I didn’t get the cutoff point to do physics...I was strong in physics from previous exams I was doing so well, but this exam I didn’t perform well and they were forcing me to do something else...so it had to call for the intervention of my physics teacher to like justify that I was a strong candidate for physics. So I did physics in my high school and I ended up getting an A.”

Because the Kenyan schooling system gives students options for careers based on exams, Tammy was unable to pursue physics in high school without the intervention of a relational resource: a teacher who vouched for her. These stan-

dardized test was a material resource that acted as a barrier to her participation in physics. There is work being done to show the inequity in standardized testing in Kenya, their findings align with similar work done in the U.S. in this area [13]. In both cases, parts of the schooling system attempted to prevent these women from participating in physics, and they both needed to find alternative ways to gain access to the field.

Another notable similarity between Tammy and Cara is the importance to engage in outreach. Both Tammy and Cara discuss participating in different outreach programs and events throughout their careers that involved mentoring younger students. Tammy believes it is important for young students to know what they can do with physics, where Cara expresses a deep passion for teaching physics in ways that students can get excited about. They also discuss benefits they receive from these activities which range from simple enjoyment to skills building. In Riché J. Daniel Barnes' *Raising the Race: Black Women Redefine Marriage, Motherhood, and Community* [14] there is discussion around the expectations that Black women face within the community. One of these is "feeling the need to contribute" and the communal responsibility that Black women take on in everyday life. This extra work load usually goes unnoticed and unacknowledged, but is a crucial function for not only the institution of physics continuing, but it is also time consuming and energy draining. This marks another way that Tammy and Cara are participating in physics in a very specific way that reflects the collective Black woman experience in America.

V. DISCUSSION

Tammy and Cara's stories serve as a useful example of the nuances that can exist amongst people with different intersecting identities. The goal of our broader work is to use the our framework to pick up on important distinctions and similarities in the ways that of Black physicists identify with the discipline, in order to understand their implications for cultivating more Black physicists. With this in mind, we see the analysis in this paper as evidence we must consider the in-

tersections of other forms of identity (i.e, gender, nationality, etc.) in order to pick up the differences in the racialized experiences of the different types of Black physicists.

This analysis suggests that there could be less of a concern with race in the ways that Tammy (who is Kenyan) experiences her physics identity. Tammy did not mention her race at all in the interview until being asked explicitly about it; she described her experiences with racism as other people's problem. Unlike Tammy, Cara brought up her race when discussing her experiences before being asked explicitly, and when asked about her race, she described it as impacting her motivation. However, both women also shared experiences with barriers in their careers that align with inequities black students face in academia [15]. Thus, we need to be more explicit about nationality (and likely other identities) in our studies, since our current protocol does not include an explicit line of questioning that unpacks the nuanced lens of race and racism for each participant. Adding some questions that point to why our participants talk about race in the way that they do (or do not) can provide more useful details about the ways that participants see race impacting their careers. It could also be useful to ask how participants define Black identity for themselves, and how this identity impacts their everyday lives in American society in order to put some of the experiences that they discuss within a broader context. These changes can better attend to a more intersectional analysis of our participants, providing richer data for analysis.

It is evident that there are important similarities and differences in the experiences that Cara and Tammy, and their case could reflect experiences of Black physicists throughout the Black Diaspora. It is important then, to examine other intersectional identities in our work as a determining factor in how Black physicists negotiate their physics and racial identities. In the future, we plan to analyze our full sample of Black physicist interviews. The findings in this paper provides motivation to be more intentional about including more voices of physicists who are not American in our sample. We plan to collect more interviews from non-American Black physicists in order to do more detailed work about how physics identity can differ across the Black diaspora.

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