

# Snowmass2021 Letter of Interest: Investment in Research Experiences for Community College Students

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## Thematic Areas:

- CommF1: Applications & Industry
- CommF2: Career Pipeline & Development
- CommF3: Diversity & Inclusion
- CommF4: Physics Education
- CommF5: Public Education & Outreach
- CommF6: Public Policy & Government Engagement

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## Introduction

Within the educational and professional field of Physics there is a well-known lack of diversity. In STEM fields in general, students with backgrounds and identities that are historically underrepresented leave the field at higher rates [1, 2]. This disparity increases throughout the typical academic path from Bachelor's to PhD and continues to increase into permanent faculty and staff scientist positions. There are many ongoing conversations of how to fix pipeline issues, whether it is addressing systemic, structural, and cultural issues to prevent 'leaks,' or to remove barriers to enter the pipeline at all. Community college students in the US are at one of the earliest starting points along the pipeline. Community colleges serve a more diverse student population than four-year universities on average [3, 4], particularly when considering historically underrepresented and marginalized students in Physics, first generation college students, and students from low-income backgrounds. We believe research internships targeting community college (CC) students will subsequently increase diverse participation starting at the Bachelor's and PhD level. This LoI presents three successful CC focused research experiences in order to elicit discussion of how we can leverage these successes to provide more opportunities to traditionally underrepresented students in Physics.

Two avenues discussed so far are **(1) Case studies of successful community college research programs.** These studies would be funded by institutions like APS, AIP, or NSF which would strengthen the case for funding of such programs by national funding agencies and individual universities. **(2) Creation of a national community college focused internship program.** This program could focus on inviting CC students to four-year universities to complement the success of such internships that already exist at National Labs.

## Community Colleges in the US

Community colleges prepare students for transfer to four-year universities and also offer terminal Associate's Degrees. Typically, to be eligible to transfer, students spend two years taking what are broadly considered the essential introductory math sequence for a physicist (i.e. calculus, linear algebra, differential equations) as well as a full four-semester sequence of calculus-based physics. In addition to these core classes, many CCs offer electives in programming (e.g. C++ or python) as well as courses covering introductory electronics. The primary point to appreciate is that with respect to the *in class* education, students attending a CC are as well-equipped with the course content as those attending a four-year institution. Upon completion of this program, students who transfer complete the final two years of upper division physics (e.g. quantum mechanics, statistical mechanics) at the degree-granting institution. In terms of the official certification, students graduating with this sequence of education have the same degree as students who attend a four-year institution for the entire duration of university. The primary difference in the educational experience and subsequent intellectual growth is due to the difference in the access to opportunities *outside the classroom* and the professional network that exposes the student to research and mentorship.

## Landscape of Community College Research Programs

Organizing and funding research programs at CCs themselves is difficult for two primary reasons : (1) the higher teaching load for CC faculty and (2) the lack of research funding at CCs. Moreover, even when a CC student does participate in research with faculty at their institution, they often do not have access to research infrastructure and technical equipment that can be found at national labs and larger R1 universities. This can be particularly detrimental for students interested in instrumentation. Programs that invite CC students to join research at four-year universities have been developed by PIs who are personally interested in outreach to CCs. The following are examples of successful programs within the University of California system :

- [Lamat Summer Research Program in Computational Astrophysics](#)
- [Research Experience for Undergraduates in Sustainable Materials](#)

These are grass-roots programs that are university specific. Funding for such programs can be short-term and sporadic, often continuing as long as whomever is an advocate for these programs receives funding.

There is one national program specifically geared towards CCs which is funded by the DOE: the [Community College Internships \(CCI\)](#) program. This program invites selected CC students to join research at any of the 13 National Labs in the US. The NSF funds REUs at universities. CC students are eligible to apply, but are competing with students at four-year universities which can put them at a disadvantage given the lack of previous research experience to support their application, and possible ‘prestige bias’ [5, 6, 7]. NASA funds the [Minority University Research and Education Project \(MUREP\)](#) program which provides educational initiatives for CC students, but not internships. CC focused internships have been funded in the past at NASA, but again these are sporadic, and are funded in the short term.

### **Investment in Research Experiences for Community College Students**

A sustainable national program that targets CC students specifically to join research at four-year universities is needed. The successes of the DOE CCI program, and programs at four-year universities in increasing diversity should be used to promote the importance of recruiting CC students to participate in research. Cultural acceptance of community college students as capable members of our field could be normalized through case studies of successful CC program funded through APS, AIP, or NSF. Data from such studies should be used to impress the importance of these programs in congressional visits, at national funding agencies, at universities, and to the public. We also propose this coordinated public relations effort should be used to push for funding of national CC specific programs at four-year universities, and for the continued support/expansion of the DOE CCI program. We invite co-authors to discuss how we define ‘success,’ what are gaps in diversity data that institutions collect now, and how can we use such data effectively?

## References

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