QSEC
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Building Student Interest in Quantum Careers: Quantum Pathways Programs

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GEORGE MASON UNIVERSITY

Chesapeake Section of the
American Association of Physics Teachers
Spring 2024 Semi-Virtual Meeting
March 16, 2024 @ DelawareStateUniversity

NSF

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Pathways to Quantum Immersion Program

- Summer program for rising high school seniors in the DMV
- Extended Deadline: Monday March 18 (end of day)
- Information linked from: go.gmu.edu/QuantumEd

Asynchronous virtual learning required *(upon completion, students will receive an electronic badge)*

Wednesday, June 26 through Wednesday, July 10

Attendance to all of the in-person session is required for participation

Sunday, July 14 through Friday, July 19

In-person, overnight, on-campus program at George Mason University, Fairfax, VA

To apply, scan or visit go.gmu.edu/QuantumImmersion

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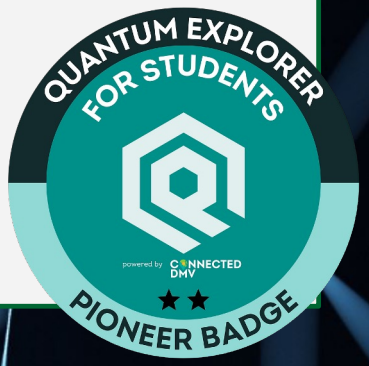
POTOMAC QUANTUM INNOVATION CENTER
powered by CONNECTED DMV

Pathways to Quantum Immersion Program

- Program run in summer 2022 and 2023
  - 13 students in 2022, 24 students in 2023
- 2 weeks virtual program
  - Credly “Introductory” badge for completion
- 1 week immersive in-person career connected experience
  - Non-residential in 2022
  - Residential in 2023
  - Extended “internship” experiences for some students
- Opportunity to create and present QWC poster
  - Credly “Pioneer” badge for completion of poster



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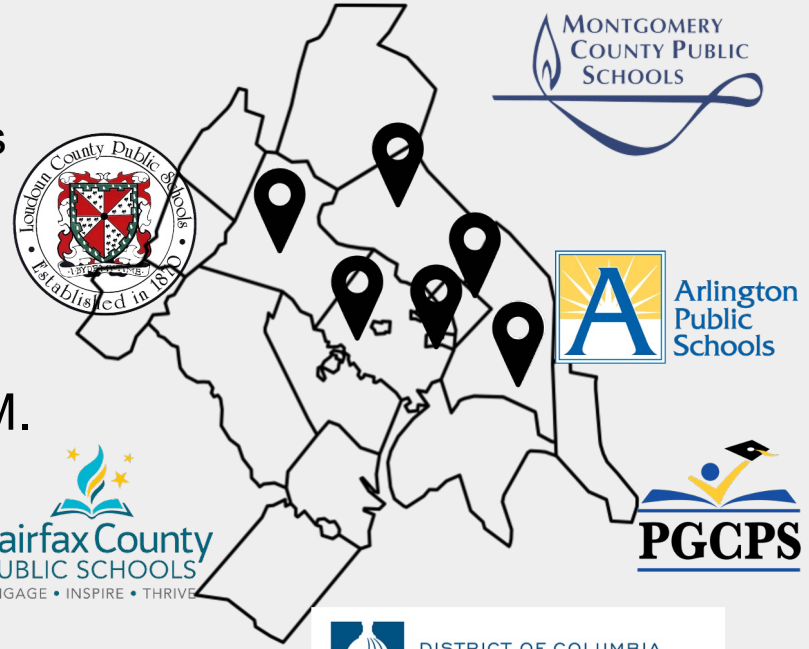
Pathways To Quantum: Student Metrics

250+ Applicants.
13 selected in 2022, 24 selected in 2023
Represented 6 large local school districts

57% of Pathways students were women.

27% from underrepresented groups in STEM.

19% first generation college students.



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Quantum Immersion for High School Students

- 2 weeks online learning about key concepts, applications, and careers
  - Introduction
  - Quantum states and superposition
  - Quantum measurement
  - Quantum entanglement
  - Quantum applications
  - Quantum careers

QUANTUM DISCOVERY FOR STUDENTS
powered by CONNECTED DMV
INTRODUCTORY BADGE

Introductory Module
This module will introduce your to quantum science and give you a

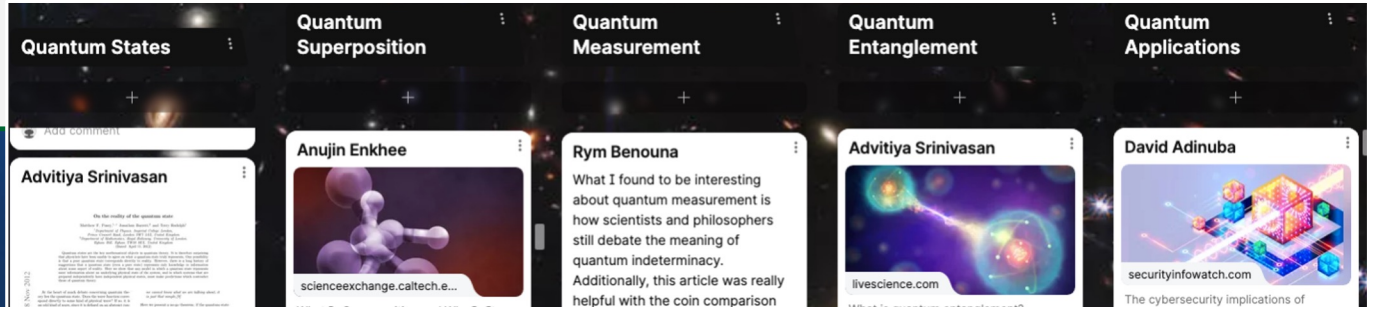
Introduction to Quantum Weirdness
In this module you will have the chance to play with some of the stra
you and with some simulations. The goal is to have you play with ar
world. You should have received a set of polarizing filters in the mail

- describe 2 ways to observe quantum effects
- compare quantum and classical expectations for the 3 polariz
- design an experiment with the double slit simulation and prec
- discuss the possible implications of the quantum effects that

Quantum States and Superposition
Welcome to the module on quantum states and superposition. Thes
to these ideas, but we want to give you a feel for what they are.

Quantum Measurement
This module will introduce you to the idea of measurement. You hav
in that it works to get information about a property of the quantum sy

Quantum Entanglement
This module will introduce you to the concept of entanglement. Wh
reaching implications when we consider how to apply quantum scie
companion, even when they are far apart.



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Sunday, July 9	
4:30 - 6:00	Introductions and icebreakers
6:00 - 7:00	Dinner (The Halal Guys)
7:00 - 8:30	Scavenger hunt around campus Return to Sandbridge Lobby
8:30 - 10:00	Counselor-led ice breakers
Monday, July 10	
9:00 - 9:45	Welcome to Mason and Introduction to QSEC and PQIC
9:45 - 10:30	Quantum Questions
10:30 - 11:00	Introduction to quantum recap
11:00 - 11:15	Break
11:15 - 12:30	Introduction to Spectroscopy
12:30 - 1:30	Lunch (Old Blue BBQ)
1:30 - 5:15	Lab tours and quantum questions
5:15 - 6:30	Break
6:30 - 7:30	Dinner (Marcos Pizza)
7:30 - 8:30	Campus tour
8:30 - 10:00	Game night in the dorm

Tuesday July 11	
7:15	Bus leaves for NASA Breakfast (Panera)
8:30-11:30	NASA tour
12:00-12:45	Lunch + UMd Undergrad Quantum Assoc (Panera, bag)
12:45 - 5:30	UMD/JQI/Nuke tours
5:30	Bus returns to Mason
6:30 - 7:30	Dinner (Old Blue BBQ)
7:30 - 10	Movie night
10:00	In the dorms for the night
11:00	In rooms/quiet time
Wednesday July 12	
8:00-9:15	Breakfast (Panera)
9:15	Bus leaves for Mitre
10:00 - 2:00	Tour of Mitre (students bring Panera lunch)
3:00 - 5:30	Quantum problems and post-program projects
5:30 - 6:30	Quiet time
6:30 - 7:30	Dinner (Moe's)
7:30 - 9:30	Quantum board game challenge
10:00	In the dorms for the night
11:00	In rooms/quiet time

Thursday July 13	
9:00 - 12:30	GWU nano-fabrication lab tour
12:30 - 1:30	Lunch (Panera, bag)
1:30 - 4:00	Office of Science and Technology Policy
5:00 - 6:30	Break
6:30 - 7:30	Dinner (Mezeh)
7:30 - 9:00	Interviews
9:00 - 10:00	Observatory
Friday July 14	
9:00-9:15	Announcements
9:15 - 10:30	Presentation preparation
10:30 - 10:45	Break
10:45 - 11:45	Quantum clubs + QWC prep work
11:45 - 12:00	Evaluation
12:00 - 1:00	Lunch (Panera)
1:00 - 1:30	Student panel
1:30 - 2:30	Student presentations

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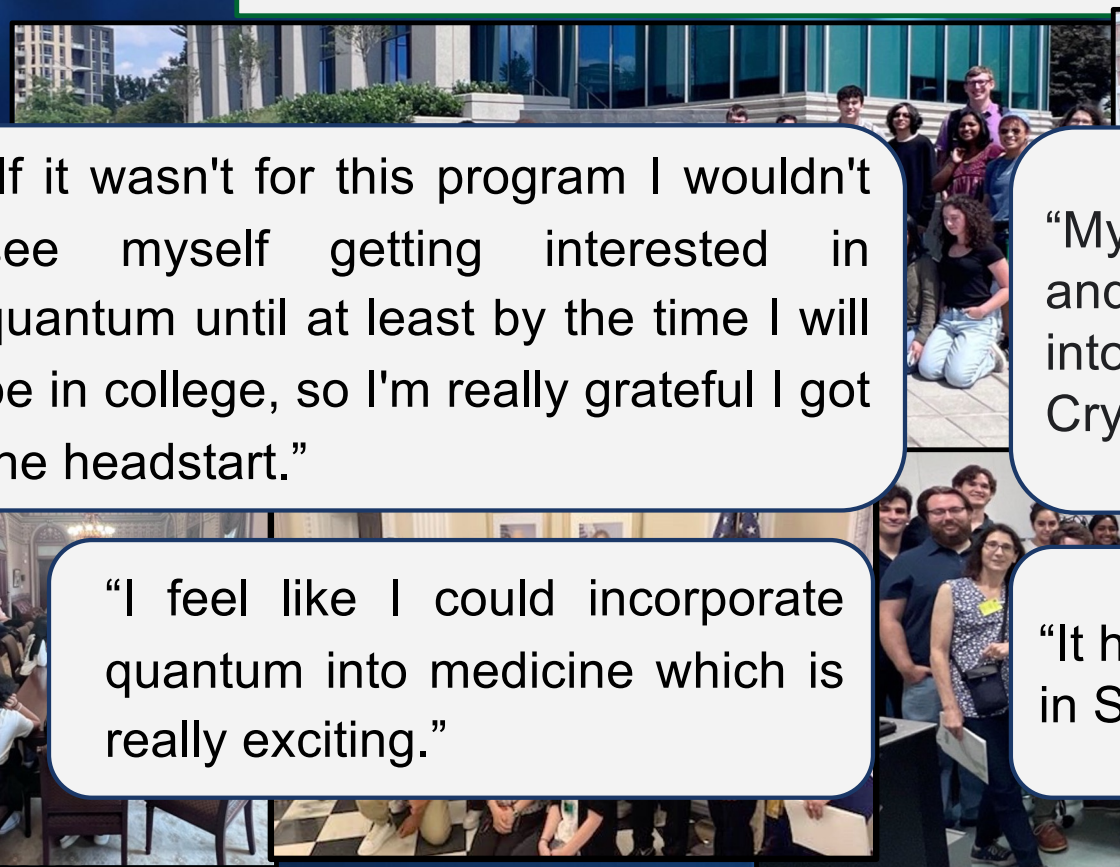
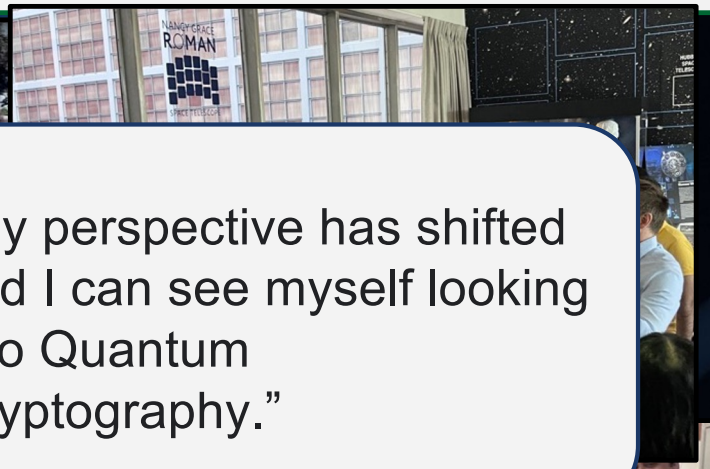
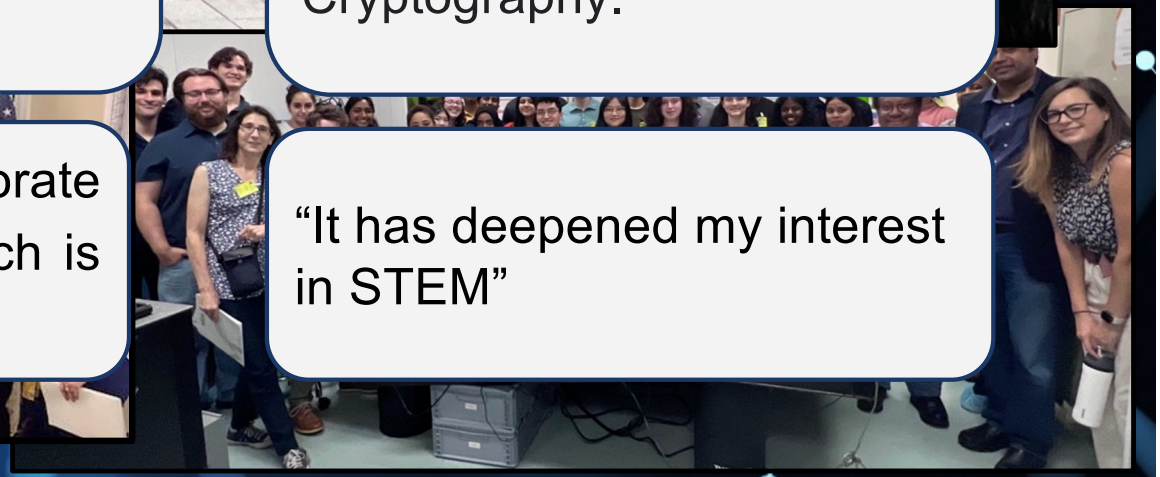
Quantum Immersion for High School Students

2 weeks online learning key concepts and about careers and applications
1 week immersive career-focused in-person







"If it wasn't for this program I wouldn't see myself getting interested in quantum until at least by the time I will be in college, so I'm really grateful I got the headstart."

"My perspective has shifted and I can see myself looking into Quantum Cryptography."

"I feel like I could incorporate quantum into medicine which is really exciting."

"It has deepened my interest in STEM"

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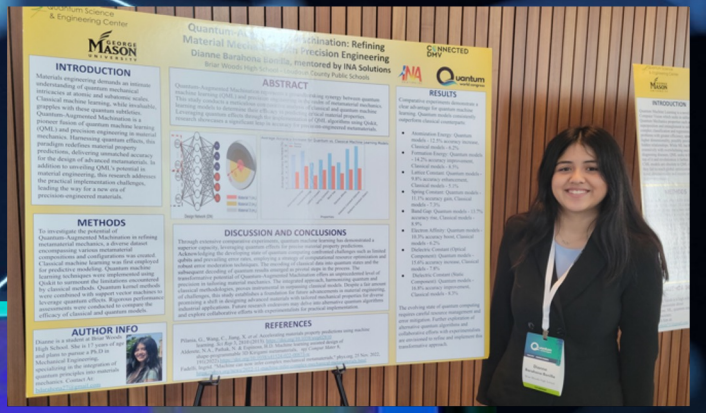
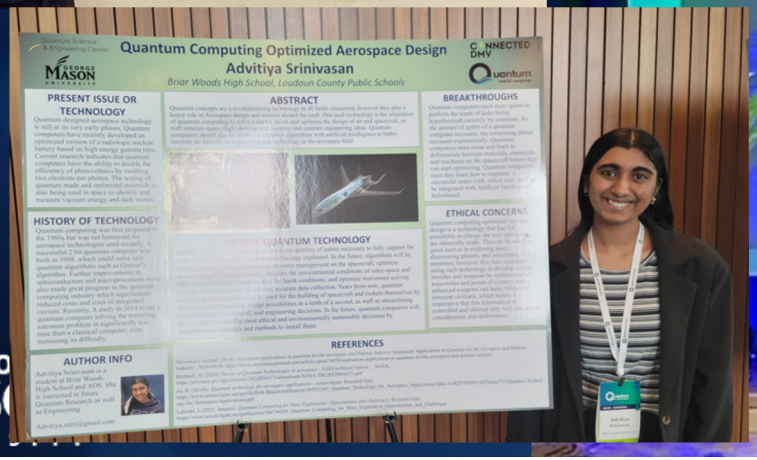
Optional internships and QWC Posters





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SUMMER INTERNSHIP & RESEARCH (2022 & 2023)

21	**Student Internships & Research Experiences:**
3	Quantum Chemistry Simulations with Fei Li (Mason)
1	Nano Materials Lab with Pilgyu Kang (Mason)
6	Quantum Computing And Machine Learning With INA Solutions Inc (INA Solutions)
8	Developed Educational Materials, Helped in a Quantum Workshop, and Engaged with Teachers (Mason)
2	Quantum Materials lab work with Patrick Vora (Mason)
1	Quantum algorithms with Maria Emelianenko (Mason)

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Quantum Pathways Program Pilot

TABLE IV. Percent of institutions surveyed and the distribution of QIS courses (at any level) by Carnegie classification.

Institution type	% Inst. Surveyed (N)	% Inst. with QIS courses (N)
Doctoral	63% (193)	86% (64)
Master's	21% (64)	7% (5)
Baccalaureate	16% (48)	7% (5)

Cervantes et al. 2021: 10.1119/perc.2021.pr.Cervantes

- Most MS and primarily undergraduate institutions don't offer QIS courses
- 2-year colleges do not offer QIS courses
- At Mason, with QIS courses and programs, many STEM students don't know about them

Quantum Pathways Program Pilot

One-day workshop to introduce community college and PUI students:

- What is quantum
- What kinds of careers are available in quantum
- What are some of the pathways to engaging in these careers

I don't know what I can do with it in terms of being a mechanical engineer, but being in this workshop kind of makes me feel like oh, maybe I can do something with it.

-Student getting AS in Mech. Eng.

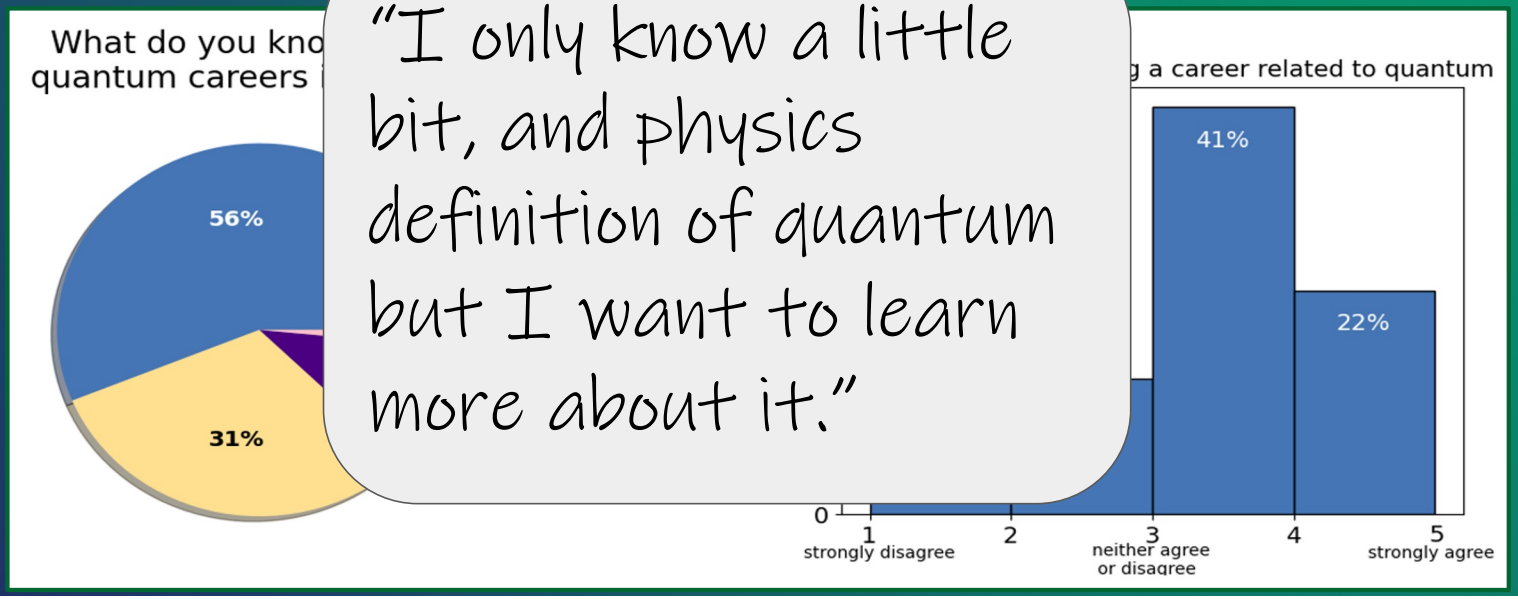
Quantum Pathways Program Pilot

Planning underway for more workshops

- Howard University
- Bowie State University

We need to let students know what is possible

Students know little about quantum but are interested in quantum careers



"I only know a little bit, and physics definition of quantum but I want to learn more about it."

Students are excited to learn about quantum and quantum careers – we need to make sure that we are providing on ramps to a wide range of students

Contact me:

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