

REU-CAAR: Research Experience for Undergraduates in Combinatorics and AI for Applied Research

William Gasarch-Director
Laxman Dhulipala-Co Director
Mentors!
Students!

Time and Money

This is a 10-minute version of a much longer recruitment talk.

Time and Money

This is a 10-minute version of a much longer recruitment talk.

One of the projects in this program was

Time and Money

This is a 10-minute version of a much longer recruitment talk.

One of the projects in this program was

1) Added Late

Time and Money

This is a 10-minute version of a much longer recruitment talk.

One of the projects in this program was

- 1) Added Late
- 2) Of interest to people taking this class

Time and Money

This is a 10-minute version of a much longer recruitment talk.

One of the projects in this program was

1) Added Late

2) Of interest to people taking this class

Hence I will talk briefly about the REU program and then briefly about the new project.

Time and Money

1. June 1- August 14 (10 weeks) (Move in and welcome dinner on May 31).
2. \$7000 stipend.
3. Housing and some Meal Money.
4. Excellent student-to-teacher ratio.
5. For more info
<https://www.cs.umd.edu/projects/reucaar/>
(Thats the REU-CAAR website)
and
<https://www.cs.umd.edu/~gasarch/REU/reurecruit2026.pdf>
(Thats the long version of this talk)

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

There are many **alternative** approaches to computing.

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

There are many **alternative** approaches to computing.

Students on this project will explore the landscape of alternative computing and the problems they may be good on.

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

There are many **alternative** approaches to computing.

Students on this project will explore the landscape of alternative computing and the problems they may be good on.

The next two slides have

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

There are many **alternative** approaches to computing.

Students on this project will explore the landscape of alternative computing and the problems they may be good on.

The next two slides have

1) Alternative Computing Device.

Alternative Computing Project

Mentors Bill Gasarch and Bill Regli

Prereq Intro Programming, Discrete Math, Algorithms, models of computation (CMSC 452), Numerical methods preferred but not required. (Important that you LIKE these topics.)

There are many **alternative** approaches to computing.

Students on this project will explore the landscape of alternative computing and the problems they may be good on.

The next two slides have

- 1) Alternative Computing Device.
- 2) Problems they might be better on that digital.

Alternative Computing Devices

Alternative Computing Devices

1) Memristors:

Alternative Computing Devices

1) Memristors: Circuit that use continuous input.

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems:

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines:

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .
- 4) analog computers:

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .
- 4) analog computers: Uses a physical phenomena like electricity.

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .
- 4) analog computers: Uses a physical phenomena like electricity.
If you want to solve a diff equation set up a physical system that it models and see what the system does.

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .
- 4) analog computers: Uses a physical phenomena like electricity.
If you want to solve a diff equation set up a physical system that it models and see what the system does.
- 5) other ideas.

Alternative Computing Devices

- 1) Memristors: Circuit that use continuous input.
- 2) Photonic systems: Computing with Light.
- 3) Ising machines: Uses Statistical Mechanics and Magnetism .
- 4) analog computers: Uses a physical phenomena like electricity.
If you want to solve a diff equation set up a physical system that it models and see what the system does.
- 5) other ideas.

Note We left out quantum computing intentionally. There is already a lot of research there and it seems rather long term.

Problems that Alt Computing Devices Might Be Good At

Problems that Alt Computing Devices Might Be Good At

1) Convolutions. There are ways to do this with analog circuits.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.
- 3) Sorting. While easy to do, a good proof-of-concept problem.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.
- 3) Sorting. While easy to do, a good proof-of-concept problem.
- 4) Factoring. Might do Quad Sieve Alg on a light computer.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.
- 3) Sorting. While easy to do, a good proof-of-concept problem.
- 4) Factoring. Might do Quad Sieve Alg on a light computer.
- 5) SAT. Physical Systems that find a min or max may help here.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.
- 3) Sorting. While easy to do, a good proof-of-concept problem.
- 4) Factoring. Might do Quad Sieve Alg on a light computer.
- 5) SAT. Physical Systems that find a min or max may help here.
- 6) Simulation of Physical Systems. This was the original motivation for Quantum Computing.

Problems that Alt Computing Devices Might Be Good At

- 1) Convolutions. There are ways to do this with analog circuits.
- 2) Fast Fourier Transforms. There are ways to do this with analog circuits.
- 3) Sorting. While easy to do, a good proof-of-concept problem.
- 4) Factoring. Might do Quad Sieve Alg on a light computer.
- 5) SAT. Physical Systems that find a min or max may help here.
- 6) Simulation of Physical Systems. This was the original motivation for Quantum Computing.

'Better than Digital?' Might use different measure than time and space such as Communication, Energy, size-of-machine.

Applying to REU-CAAR

Qualifications

1. Good math background, CMSC 351, CMSC 452.
2. Knowing how to program.
3. Interest in the topic!

How to apply

How to apply

How to apply: Goto REU CAAR website or NSF ETAP website.
Will need:

How to apply

How to apply: Goto REU CAAR website or NSF ETAP website.

Will need:

1. Transcript (including Fall 2025)

How to apply

How to apply: Goto REU CAAR website or NSF ETAP website.
Will need:

1. Transcript (including Fall 2025)
2. Statement of Purpose (say which ≥ 2 projects you want to work on, Why you are **interested** and why you are **qualified**)

How to apply

How to apply: Goto REU CAAR website or NSF ETAP website.
Will need:

1. Transcript (including Fall 2025)
2. Statement of Purpose (say which ≥ 2 projects you want to work on, Why you are **interested** and why you are **qualified**)
3. Letters of rec. (Letter writers will submit those)

How to apply

How to apply: Goto REU CAAR website or NSF ETAP website.
Will need:

1. Transcript (including Fall 2025)
2. Statement of Purpose (say which ≥ 2 projects you want to work on, Why you are **interested** and why you are **qualified**)
3. Letters of rec. (Letter writers will submit those)
4. Other stuff that is on form

Logistics and other Issues

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)
<https://reu.cse.sc.edu/>

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)
<https://reu.cse.sc.edu/>

NSF website of REU programs:

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)
<https://reu.cse.sc.edu/>

NSF website of REU programs:
<https://www.nsf.gov/funding/initiatives/reu/search>

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)

<https://reu.cse.sc.edu/>

NSF website of REU programs:

<https://www.nsf.gov/funding/initiatives/reu/search>

REU FINDER for STEM:

Logistics and other Issues

- 1) **YOU** apply by March 1, though the letters can come in later.
- 2) Apply NOW as the NSF website is down on weekends.
- 3) These programs are very competitive so apply to many:
RQS-UR. Robust Quantum Simulation at Univ of MD.
<https://rqs.umd.edu/education-workforce/undergraduate>

REU-QIS (Quantum Info Sci at Univ of SC)
<https://reu.cse.sc.edu/>

NSF website of REU programs:
<https://www.nsf.gov/funding/initiatives/reu/search>

REU FINDER for STEM:
<https://reufinder.com>