REU-CAAR: You’re Here!
Origin of this talk
Credit where Credit is Due

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▶ In 2010 a Univ of MD Cybersecurity REU produced a 20-page document:

Cybersecurity Scholars Handbook.
Credit where Credit is Due

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- Bill G modified this *boring* handbook into a *fascinating* ∼ 280-slide talk!
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Auguste: Why are you telling them all that?
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- Bill G modified this **boring** handbook into a **fascinating** ~ 280-slide talk!

**Auguste:** Why are you telling them all that?

**Bill:** In academia its very important to credit past work!
Purpose of This Talk
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1. Who are the mentors?
Purpose of This Talk

1. Who are the mentors?
2. What are the projects?
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2. What are the projects?
3. What is expected of you?
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5. Nuts and bolts of how the program works.
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1. Who are the mentors?
2. What are the projects?
3. What is expected of you?
4. What should you expect of us?
5. Nuts and bolts of how the program works.
6. Advice on how to get the most out of this summer!
REU: Research Experience for Undergraduates.
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CAAR: Combinatorics, Algorithms, and AI for Real Problems.
REU-CAAR

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CAAR: Combinatorics, Algorithms, and AI for Real Problems.

Discuss Find a topic within CS that this title does not cover?
REU: Research Experience for Undergraduates.
CAAR: Combinatorics, Algorithms, and AI for Real Problems.

Discuss Find a topic within CS that this title does not cover?

Systems, HCI, Software Engineering, anything else?
REU-CAAR: TEAM!
Mentors

1. Classical and Quantum Error Correction: Victor A and Phillip F.
2. Improved Machine Translation for Wikipedia: Marine C and Eleftheria B.
3. Parallel Algorithms for High Dimensional Clustering: Laxman D.
4. Fair Decision Making: Furong H.
5. Exploring the Hilbert Geometry: Auguste G. and Dave M.
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Admin

▶ REU-CAAR Director: William Gasarch.
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REU-CAAR Director: William Gasarch.

Wrote the grant, finds the mentors,
Admin

- **REU-CAAR Director:** William Gasarch.
  Wrote the grant, finds the mentors, does admissions,
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- **REU-CAAR Director:** William Gasarch. Wrote the grant, finds the mentors, does admissions, manages the REU-CAAR website, makes decisions on housing,
Admin

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  Wrote the grant, finds the mentors, does admissions, manages the REU-CAAR website, makes decisions on housing, lunch activities,
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  - **Your Salary:** Jodie Grey.
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- **Airport, Amtrak Pickups:** Darling, Clyde, Rob, Auguste.
- **Help with Final Presentations:** Clyde.
REU-CAAR: Very Brief History
The Original Grant

In 2013 Samir K. and Bill G. applied to the National Science Foundation (NSF) for an REU grant titled
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From 2013-2016 we had projects in

- Crypto and Security
- Data Science
- Ramsey + Something more Applied (AI, ML, SAT-Solvers)
- Applied Algorithmic Graph Theory
- Algorithmic Game Theory
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2017-2022

Big change. Projects in the fields above but also
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The AI projects all had a mathematical component.

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**Combinatorics, Algorithms, and AI for Real Problems.**
The REU-CAAR Grant


Bill has been the PI (Principle Investigator) 2013-2024.

2. Samir was coPI (co-Principle Investigator). 2013-2019

3. Samir left UMCP, became chair at NW in Spring 2020. John Dickerson has been co-PI 2020-2024.

4. For 2022-23-24 we got additional money for a helper. In 2022 Auguste is that helper. He will (1) co-mentor a group, and (2) help Bill with a lot of stuff.
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Other REU Programs We Will Interact With

1. Mihai Pop got a grant for REU-BRIDGE (Bioinformatics Research in Data science for Economics) for 2022-23-24. This REU program is at Univ of MD at College Park.

2. Maria Cameron got a grant for REU-MATH (Modern Topics in Applied and Pure Math) for 2023-24-25. This REU program is at Univ of MD at College Park.


4. We will share some activities with these REU programs.
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Program Goals and Expectations
Program Goals

1. **Research!** What is Research? Discuss!

   Work on problems where the answers are not already known.

   Expose you to a variety of career paths. Discuss! Grad School, Industry, Government, Writer for the Simpsons, Hobo, Other.

   Build skills Team Work, Communication, Project Management.

   Build a network with faculty and students. Useful for the future!
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   Grad School, Industry,
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3. **Build skills**
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   Useful for the future!
What the Program Expects of You

1. Show up every weekday.
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1. Show up every weekday. On time and sober.
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1. Show up every weekday. On time and sober.  
   10:00AM-4:00PM
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This is the Wrong Way To Look at the program
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I Invite you to talk about jobs you’ve had. I’ll go first.
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1. This program should not be seen as a job where you put in your 8 hours a day and then you’re free to to what you want.
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Upshot

1. This program should not be seen as a job where you put in your 8 hours a day and then you’re free to do what you want.

2. You are here because you care about Quantum or AI or Bias or Geometry or Mitigating Climate Change.
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Upshot

1. This program should not be seen as a job where you put in your 8 hours a day and then you’re free to to what you want.
2. You are here because you care about Quantum or AI or Bias or Geometry or Mitigating Climate Change.
3. So you should want to keep working on your projects, perhaps on a lower level, after you go back to the dorms.
What the Program Expects of You

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2. You are here because you care about Quantum or AI or Bias or Geometry or Mitigating Climate Change.
3. So you should want to keep working on your projects, perhaps on a lower level, after you go back to the dorms.
4. Talk to each other in the dorms about your projects!
What the Program Expects of You: Restart

1. **Show up** every weekday.

2. Participate in assessments such as surveys.

3. Actively contribute to your research project and your team.

4. Check e-mail. Reminders, notices, requests will be emailed.

5. **Enthusiasm!**

6. Attend lunches, talks, and other activities.

7. Great talks: Attend them and at the end of the semester you will give them.

8. Enjoy yourselves!

First letters spell SPACE AGE. Better for an astronomy REU.
What the Program Expects of You: Restart

1. **Show up every weekday.** On time AND sober.
What the Program Expects of You: Restart

1. **Show up** every weekday. On time AND sober. 10AM-4PM.

(First letters spell SPACE AGE. Better for an astronomy REU.)
What the Program Expects of You: Restart

1. **Show up** every weekday. On time **AND** sober. 10AM-4PM. You should want to work longer, but prob back in the dorms.
What the Program Expects of You: Restart

1. **S**how up every weekday. On time AND sober. 10AM-4PM. You should want to work longer, but prob back in the dorms.
2. **P**articipate in assessments such as surveys.
What the Program Expects of You: Restart

1. **Show up** every weekday. On time AND sober. 10AM-4PM. You should want to work longer, but prob back in the dorms.

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3. **Actively contribute** to your research project and your team.

4. **Check e-mail.** Reminders, notices, requests will be emailed.

5. **Enthusiasm!**

6. **Attend** lunches, talks, and other activities. (Talks and some activities joint with REU-BRIDGE.)

7. **Great talks:** Attend them and at the end of the semester you will give them. (Joint presentation with REU-BRIDGE.)

8. **Enjoy yourselves!**

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What the Program Expects of You: Restart

1. **Show** up every weekday. On time AND sober. 10AM-4PM. You should want to work longer, but prob back in the dorms.
2. **Participate** in assessments such as surveys.
3. **Actively** contribute to your research project and your team.
4. **Check** e-mail. Reminders, notices, requests will be emailed. (I hyphenated email? Why? The original handbook did this and I wanted you to see an interesting piece of history. X-ray and T-shirt kept the hyphen but email did not. Why?)
5. **Enthusiasm!**
6. **Attend** lunches, talks, and other activities. (Talks and some activities joint with REU-BRIDGE.)
7. **Great talks:** Attend them and at the end of the semester you will give them. (Joint presentation with REU-BRIDGE.)
8. **Enjoy** yourselves! First letters spell SPACE AGE. Better for an astronomy REU.
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Your Mentor’s Role

1. **Role modeling:** Their experiences offer clues for your own professional success story.
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3. **Background:** Explain **why** the research is important! How it fits into other things!

4. **Connection:** Help connect you to their colleagues, graduate assistants, others.
What Faculty Mentors Expect from You

1. **Communication:**

   - Be clear in verbal & written comm.
   - Seek clarification, ask questions, provide suggestions.

2. **Assertiveness:**

   - Think for yourself and support your own ideas.

3. **Maturity:**

   - Be reliable for what your mentor asks you to do.

4. **Enthusiasm:**

   - Be interested in the project, field, and topic.

5. **Responsible:**

   - Tell your team when changes affect your participation.

6. **Adaptability:**

   - Be flexible and open-minded.

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Issues that Probably Won’t Arise But Need to be Discussed
Sexual Harassment and Discrimination

1. If you feel uncomfortable, seek advice and guidance from others. Bill, Auguste, or Furong (One of the REU-CAAR mentors) can offer assistance and direct you to campus resources for help. Note that in the United States there is Mandatory Reporting: if a mentor or director hears about a case of sexual harassment, they must report it.

2. While this slide is about Sexual Harassment and Discrimination, feel free to talk to Bill, Auguste, or Furong about any issue, even if it is uncomfortable.
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Do Your Part

Good News That You Know:

1. You get a stipend.
2. You get free room and some meal money.

If you do not do your part you could be asked to leave, which will mean you get less of your stipend. This is RARE! (once in 2014 and once in 2016).

What is 'your part':

SPACE AGE and CAMERA
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SPACE AGE and CAMERA
Complain SOONER Rather than Later

Better to get a problem resolved EARLY, whatever they are.
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Key to a good relationship:
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In any problem or dispute that arises the important thing is
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Complain SOONER Rather than Later

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Key to a good relationship:

In any problem or dispute that arises the important thing is not fixing it and making things work out its finding whose to Blame :-()
Schedule and Activities
First Week++ Talks

You should all know about each others projects:
First Week++ Talks

You should all know about each others projects:

For all projects $p$
First Week++ Talks

You should all know about each others projects:

For all projects $p$

there exists a mentor $m$ for project $p$ and a day $d$ such that
You should all know about each others projects:

For all projects $p$
there exists a mentor $m$ for project $p$ and a day $d$ such that
mentor $m$ gives a talk on project $p$ on day $d$. 
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In symbols

$\forall p \exists m, d [MENTOR(p, m) \land TALK(p, m, d)]$. 
First Week - Lunch

1. Monday 12:00-1:00 lunch in IRB.
2. This lunch you will play telepictionary!
3. Tu,We,Th,Fr- Lunch in the union or IRB from your meal card.
4. Bill will join you for lunch some of the first week.
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First Week

1. Red Tape stuff (hopefully ends Tues).
2. Every day of the first week, at 4:00, a talk by a mentor on their project.
3. Research—Every day.
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Most Weeks

1. Get here by 10:00AM go to your projects room.
2. Research 10:00-12:00 (approx)
3. Lunch 12:00-1:00 (approx). MONDAY lunch IRB
4. Research 1:30-4:00.
5. Talks on Thursday afternoons at 4:00.
6. Every other Friday you get your paycheck! Don't blow it all on supercomputer time!
7. At night talk about Applying Quantum error correction, ML, and Geometry to Mitigate World Hunger
8. Weekends— Explore Washington DC! or College Park! (Check the metro website—lots of trains are not running at times.)
9. Some of these items may change (e.g., lunches, talks may be a diff day).
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Explore Washington DC On Your Own AND

1. Very few of you are locals. Use cell phones.
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   U. of Del undergrad Joe Biden did an honors thesis on
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   Howard U. undergrad Kamala Harris did an honors thesis on
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   Jill Biden is the first First Lady to have a PhD.
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There is a Metro Stop in College Park.
There is a Metro Stop in College Park. **YEAH!**
College Park Metro Station

There is a Metro Stop in College Park. **YEAH!**

It will stop running around July 2.
There is a Metro Stop in College Park. **YEAH!**

It will stop running around July 2. **BOO!**

**Upshot:** Visit President Biden and other DC sights in June.

**Upshot:** There are websites that have metro information—check them before any excursion.
There is a Metro Stop in College Park.  **YEAH!**

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When it does there are other ways to get to DC.
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Those other ways are a pain.
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When it does there are other ways to get to DC. **YEAH!**

Those other ways are a pain. **BOO!**

**Upshot:** Visit President Biden and other DC sights in June.

**Upshot:** There are websites that have metro information- check them before any excursion.
Other Things We Will Do

1. Discussion of Ethics of Research.
2. Discussion of graduate school (with the other 3 REUs).
3. Game Nights with Pizza!
4. Final presentation the last week (with the other 2 local REUs).
5. Unexpected things will happen! Always expect the unexpected! (Is that a paradox? A project for Summer 2024 REU.)
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Summary of Projects and People
Victor and Phillipe Quantum Project

1. Classical and Quantum Error Correction

2. Elevator Pitch

Alice wants to send Bob a string $x \in \{0, 1\}^n$. But the channel is noisy! There are ways to send $x$ such that errors will be detected and corrected (if there aren't too many of them.) One way is to send $xxx$. There are better ways. CLASSICALLY.

What if you had QUANTUM methods! Can you do better? They will find out!

3. Students

Michael, Cella, Milan
1. Classical and Quantum Error Correction

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3. **Students** Michael, Cella, Milan
Marine-Eleftheria Translation Project

1. Improving Machine Translation for Wikipedia

2. Elevator Pitch

Machine Translation uses deep learning. This sounds great :-). But it's not :-(. If only we had a large set of texts to experiment on and see what goes wrong. OH. We do! Wikipedia. This project will use translations of Wikipedia pages to understand and evaluate different Machine Translation Services. The goal is to see when they do badly and find ways to make them better.

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Linh, Osama, Grace, Angela
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3. Students Linh, Osama, Grace, Angela
Laxman Parallelism/Clustering Project

1. Parallel Algorithms for High-Dim Clustering

2. Elevator Pitch

Clustering is taking a set of data and grouping it in meaningful subset. EXAMPLE: take the set of students at UMCP and group them by major and by GPA and by GPA-in-the-major. For a very large dataset this is slow. What to do? What if we use a PARALLEL algorithm on a PARALLEL machine. We will implement state-of-the-art parallel algorithms and see how they do!

3. Students

Papa, Mohammad, Andrew
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3. **Students** Papa, Mohammad, Andrew
Furong’s Fair Decision Making

1. Fair Division Making

2. Elevator Pitch

At one point it was hoped that automating decisions would decrease human bias. But instead there are times when it inherits human bias. Darn! This project looks at how to deal with that (and reduce bias) in the context of ML/AI for decision making.

3. Students

Selena, Amy, David
Furong’s Fair Decision Making

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3. **Students** Selena, Amy, David
Auguste-Dave Geometry Project

1. Exploring Hilbert Geometry

2. Elevator Pitch

Computational Geometry asks questions like Given a set of lines find all of the points of intersection. It is assumed they mean lines in the plane or perhaps $\mathbb{R}^n$. What if you are in another space? A curved space? What can you do? You can do This project!

3. Students

Zofia, Sally, Daniel, Carlos.
Auguste-Dave Geometry Project

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Auguste-Dave Geometry Project

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3. Students Zofia, Sally, Daniel, Carlos.
Aviva’s Markov Decision for Climate Risk

1. Using Markov Decision Processes to Mitigate Climate Risk

2. Elevator Pitch

Farmers in India need your help! Small changes in climate lead to big changes in when to plant crops. They need to predict the weather AND tie that into decision making for crop planting. We will use MATH and AI to do this!

3. Students

Nick, Jasmine
1. Using Markov Decision Processes to Mitigate Climate Risk
Aviva’s Markov Decision for Climate Risk

1. **Using Markov Decision Processes to Mitigate Climate Risk**
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Aviva’s Markov Decision for Climate Risk

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3. **Students** Nick, Jasmine
Funding
Who is Funding This?

1. National Science Foundation (NSF).
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1. National Science Foundation (NSF). This makes sense.
2. Google/An Zhu (An Zhu was an undergrad at UMCP who worked in Theory).
3. Ocular/Brendan Iribe (A Virtual Reality Company). This makes sense.
4. Other Schools mini-grants pay stipends. This makes sense.
5. KAUST: King Abdullah Univ. of Sci. and Tech. They want to foster good relations between Saudi Arabia and America. They fund students from Saudi Arabia who are already at American Schools, to go to REU programs. This makes sense.
6. Two HS students are in the program as unpaid interns. This makes sense.
7. The Winkler Foundation. Who are they?
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Irwin Winkler

Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch
Irwin Winkler

Bill Gasarch’s Mother is Pearl (Nee Winkler) Gasarch

Pearl Gasarch’s Brother is Irwin Winkler

Irwin Winkler is a producer in Hollywood.
1. Produced over 50 movies
2. Directed 7 movies
3. David Selznick Lifetime achievement award for producing
4. Produced Rocky1, ... ,6, Goodfellows, Creed 1,2,3
5. For more about him: https://www.imdb.com/name/nm0005563/?ref_=fn_al_nm_1

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Why am I telling you this?
Irwin Winkler has established a charitable foundation that gives money to
Irwin Winkler has established a charitable foundation that gives money to (a) many worth causes and
Irwin Winkler has established a charitable foundation that gives money to (a) many worth causes and (b) our REU!
Adam Winkler is Irwin’s son who administers the foundation.

Adam Winkler has written two books: *Gunfight: The Battle over the Right to Bear Arms in America* and *We the Corporations: How American Businesses won their civil rights*. The last book got this review: “It is deeply shocking that *We the Corporations* is not boring.” Also, the last book was a nominee for the National Book Award.
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Show me the Money!

Where Does the Winkler Money Go?
Things the NSF won’t pay for:

▶ Money for housing for non-citizens.
▶ The REU Lunches.
▶ Misc.
Show me the Money!

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Does Where You Got Your Funding Matter? NO

1. Some of you are NSF funded.
2. Some of you are KAUST funded.
3. Some of you are Iribe funded.
4. Some of you are Google/Zhu funded.
5. Some of you are funded by your own school/Winkler/UMCP.
6. Some of you are not funded.
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All REU students are created equal.
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None of this will matter except:

1. Those funded by Google/Zhu or Iribe will be asked to write a letter thanking them. I will be asking this in September.
2. KAUST may ask their students to fill out forms.
3. The local HS students did not get those 100 emails asking for their travel plans.
My Wife Says that if I Lie to You I Must Tell You

Joe Biden's Senior Thesis was not on Exploring the Hilbert Geometry. It was on Classical and Quantum Error Correction.
My Wife Says that if I Lie to You I Must Tell You

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Questions from You?

I welcome questions now and anytime!