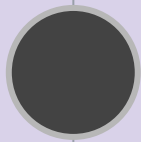




- Undergraduate
Research Opportunities
Quantum Collective

October 26th 2022 ; GDC 1.304

Undergraduate Research Opportunities



Who are we?



The Quantum Collective aims to be the central hub for all UT Austin students interested in anything quantum. That means quantum computing, quantum physics, quantum philosophy, and more. We have four core pillars to our programming: **Learning**, **Getting Connected**, **Doing Research**, and **Discovering Opportunities**. We meet these objectives through research initiatives, learning labs, directed reading programs, hackathons, and mock research conferences, among other things. We also forge strong educational ties with both academia and industry.



New Mentor! Jiahui Liu

- Student of Scott Aaronson, and Brent Waters
- Theoretical Computer Science, quantum complexity, cryptography
- You can contact her on Discord if you wish!**
- Might be giving a talk next week as well..**

[Personal Site](#)

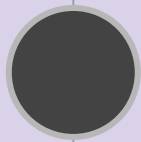




New Mentor! Haley Cole

- Student of Shyam Shankar in the ECE Dept.
- Works in superconducting quantum circuits, quantum complexity
- **You can contact her on Discord if you wish! She is currently a mentor in the hardware group.**
- **Might be giving a talk soon as well...**





Jiahui Liu's recent publications

1. [arXiv:2109.07517](#) [pdf, other] [quant-ph](#) [cs.CR](#)

Beating Classical Impossibility of Position Verification

Authors: Jiahui Liu, Qipeng Liu, Luowen Qian

Abstract: Chandran et al. (SIAM J. Comput. '14) formally introduced the cryptographic task of position verification, where they also showed that it cannot be achieved by classical protocols. In this work, we initiate the study of position verification protocols with classical verifiers. We identify that proofs of quantumness (and thus computational assumptions) are necessary for such position verification pr... [▽ More](#)

Submitted 3 January, 2022; **v1** submitted 15 September, 2021; **originally announced** September 2021.

Comments: 33 pages, 1 figure, to be published in ITCS 2022. Expanded discussions on the usage of quantum memory. Fixed discussions in the introduction regarding ABLS21, BCS21, and extending the non-local game. Fixed typos

2. [arXiv:2107.05692](#) [pdf, other] [cs.CR](#) [quant-ph](#)

Hidden Cosets and Applications to Unclonable Cryptography

Authors: Andrea Coladangelo, Jiahui Liu, Qipeng Liu, Mark Zhandry

Abstract: In this work, we study a generalization of hidden subspace states to hidden coset states (first introduced by Aaronson and Christiano [STOC '12]). This notion was considered independently by Vidick and Zhang [Eurocrypt '21], in the context of proofs of quantum knowledge from quantum money schemes. We explore unclonable properties of coset states and several applications: - We show that assuming... [▽ More](#)

Submitted 14 July, 2022; **v1** submitted 12 July, 2021; **originally announced** July 2021.

Comments: Minor updates

3. [arXiv:2004.09674](#) [pdf, ps, other] [cs.CR](#) [quant-ph](#)

New Approaches for Quantum Copy-Protection

Authors: Scott Aaronson, Jiahui Liu, Qipeng Liu, Mark Zhandry, Ruizhe Zhang

Abstract: Quantum copy protection uses the unclonability of quantum states to construct quantum software that provably cannot be pirated. Copy protection would be immensely useful, but unfortunately little is known about how to achieve it in general. In this work, we make progress on this goal, by giving the following results: - We show how to copy protect any program that cannot be learned from its input... [▽ More](#)

Submitted 16 October, 2020; **v1** submitted 20 April, 2020; **originally announced** April 2020.

Comments: major revisions in definitions and security proofs

JOIN OUR
DISCORD!

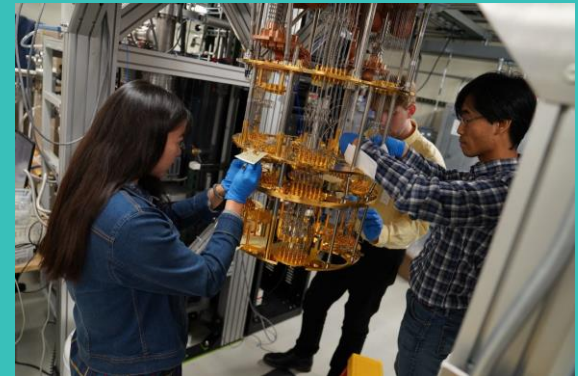


STAY CONNECTED!



IBM QURIP

- Typically held for 12 weeks!
- Possible research areas: error correction, circuit compilation, benchmarking, hardware analysis etc.
- Deadline may likely be in mid January extrapolating from previous year's program and starts around June 6th.



Caltech SURF

- Unique general undergraduate research program held at Caltech.
- Undergraduates offered fellowship to work under faculty at Caltech in any relevant area in the sciences.
- QuantumSURF ; There were ~10 faculty involved in last year's program!
- **Deadline: Feb 22nd**
- **How: Contact professors in the department beforehand to setup research opportunities.**

Waterloo URA

- URA:University Research Award
- Similar to SURF
- Undergraduates offered fellowship to work under faculty at Waterloo in any relevant area in the sciences.
- Minimum of 10 weeks. Flexibility like SURF!
- **Deadline: Jan 3rd**
- **How: Contact professors in the department beforehand to setup research opportunities**
- **<https://uwaterloo.ca/institute-for-quantum-computing/our-people>**



ARL:UT Center for Quantum Research

- ARL/UT CQR
- Don't forget about the one here!
- Michelle and Ronak, both the presidents of our club, were involved in this.
- Key Areas of Research : Quantum Optics, precision quantum, quantum communication
- **Contact either Prof. La Cour or Davis.**
- **Some FRI students in the quantum stream**
- **Spend a summer there.**



**APPLIED RESEARCH
LABORATORIES**
The University of Texas at Austin

ARL:UT Recent Publications

3. T. Cuvelier; S. A. Lanham; B. R. La Cour; R. W. Heath, “Quantum Codes in Classical Communication: A Space-time Block Code from Quantum Error Correction.” *IEEE Open Journal of the Communications Society* (2021).
<https://doi.org/10.1109/OJCOMS.2021.3121183>
4. B. R. La Cour and T. W. Yudichak, “Classical model of a delayed-choice quantum eraser.” *Physical Review A* **103**, 062213 (2021). <https://doi.org/10.1103/PhysRevA.103.062213>
5. B. R. La Cour and T. W. Yudichak, “Entanglement and impropriety.” *Quantum Studies: Mathematics and Foundations* **8**, 307 (2021). <https://doi.org/10.1007/s40509-021-00246-w>
6. B. R. La Cour and M. C. Williamson, “Emergence of the Born rule in quantum optics.” *Quantum* **4**, 350 (2020). <https://doi.org/10.22331/q-2020-10-26-350>
7. S. A. Lanham and B. La Cour, “Detection-based measurements for quantum emulation devices.” 2020 IEEE International Conference on Quantum Computing and Engineering (QCE), Denver, CO, 12-16 Oct. 2020. <https://doi.org/10.1109/QCE49297.2020.00015>
8. C. Ostrove, B. La Cour, A. Lanham, G. Ott, “Improving Performance of an Analog Electronic Device Using Quantum Error Correction.” *J. Phys. Comm.* **3**, 085017 (2019).
<https://dx.doi.org/10.1088/2399-6528/ab3c37>

NSF Funding for Quantum Research

As you might know, the NSF routinely funds undergraduate research opportunities among so many other things! Use the public website to search for opportunities for 2023 yourself.

- Learn what REUs being planned next semester are related to Quantum!
- Also learn what other general university-specific programs are receiving funding.
- Website provides a broad overview of the current state of research areas and opportunities. Quantum Information Science and Engineering Research

[Here](#) is the link for the page!



Chicago Quantum Exchange

- Another very useful general resource for finding opportunities and recent research trends
- CQE is a forum of various universities and adjacent industry partners involved in Quantum Computing. The facilities are meant to encourage collaboration amongst the various departments in the country working in quantum computing.



CHICAGO
QUANTUM
EXCHANGE

Can UT help in funding undergrad research?

- **YES!**

CNS has an **extensive** list of programs to help students secure funding for their summer research if students go through more *informal* means in securing their opportunities(i.e not REUs, or other standard programs with precedent).

- Of course, this applies for programs within UT as well, like Shankar's lab or ARL, I think the only two sites within UT where quantum computing research is being conducted.
- See this UT page for funding information, [here](#).
- Also contact your department advisors in this case as there are many other funding sources besides the official ones listed on the website.
- Don't discount this way of getting research opportunities over more standardized routes, it can potentially even be a more productive experience!

Can UT help in funding undergrad research?

- **TEJAS** - one of the well-known programs within UT for funding opportunities.
- **Important Contact: Adrienne Chacon-Posey, Scholarship Co-Ordinator;**
scholarships.cns@utexas.edu
- The **UT CS department** has more(and better) internal resources for research funding, so you should check that out if it's relevant.
- There is the **NSF funding page**(not related to the REUs), there are external programs to secure funding as well. See [here](#) , for example.
- Finally, there is an ultimate resource called **Pivot**, which you can sign into using you UT EID. You can use it to scour through an extensive database of research funding opportunities using keywords, and effectively keep track of your applications within the app.

ASK YOUR MENTORS!

- We have around 8 mentors right now, spanning a variety of subfields within Quantum Computing.
- I highly suggest asking them for some direction in pursuing these opportunities,. They have all gone through this process in some ways.



Yirka

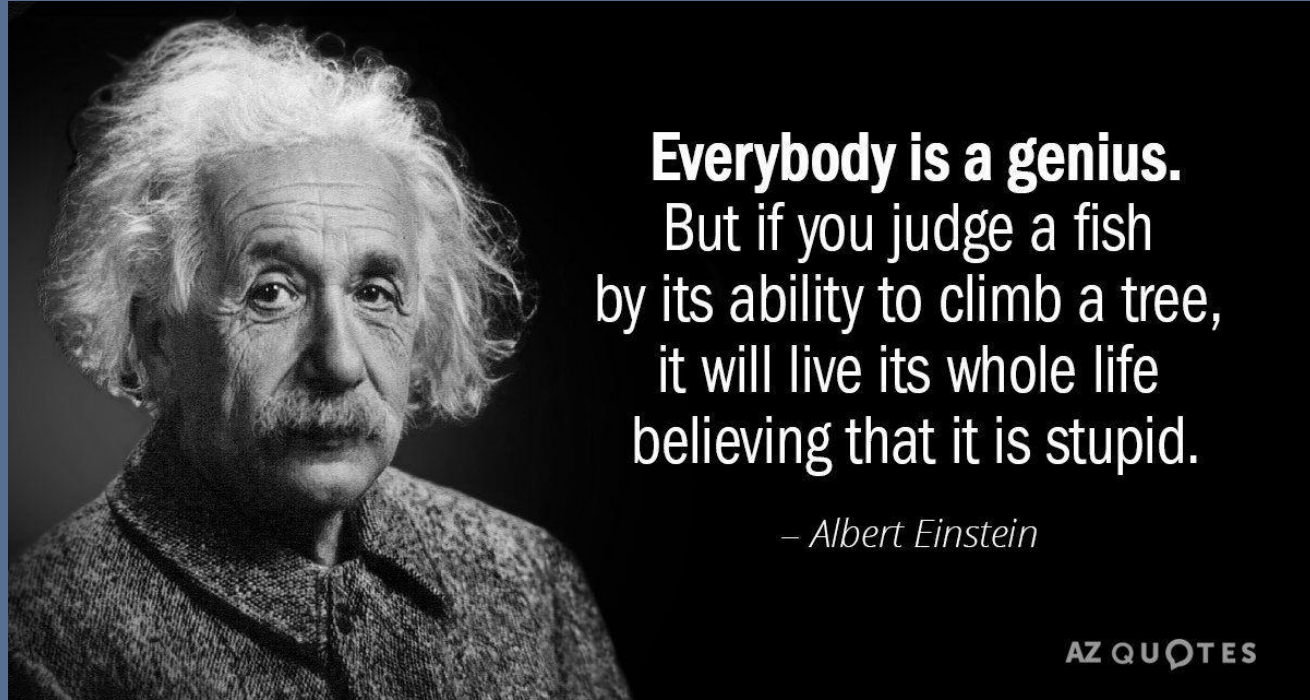


Jiahui Liu



Hebah(mentored by Shankar)

HERE IS A FAKE EINSTEIN QUOTE



● See you Next Week!

