

Contact Information

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Education

- PhD in theoretical physics at the **University of California, Berkeley**, Class of 2028.
- BSc in Physics and Mathematics (GPA: 4.9/5) at **Massachusetts Institute of Technology**, Class of 2022.

Research Interest

I aim to tackle the most **puzzling, mysterious** aspects of our universe.

- **Central dogma of quantum gravity: GR+QM=hologram?**
Instead of betting on one particular theories such as string theory or loop quantum gravity, I believe in a more general lore: *any* non-perturbative quantum theory derived from classical gravity will be holographic. Proving this “central dogma” is the goal of my PhD.
- **Do you hit a firewall when you jump into a black hole?**
Strangely enough, we have very little knowledge about dynamical observers (like ourselves!) in gravity. What happens when you jump into an old black hole? Do particles right behind the horizon (a “firewall”) kill you? Or, does the singularity suck the firewall away fast enough and incidentally save you? I have been studying these questions in toy models.

Recently, I am convinced in the urgency of **AI safety** research and have started some **transformer interpretability** projects.

Selected projects

- **Categorical features in GPT2 through the polytope lens** Ongoing
 - The mainstream in transformer interpretability research seems to be about activation space features, e.g., using the Sparse Autoencoder (SAE), while the actually essential notion should be the **computational features**.
 - Polytope lens seem to be a framework that can connect the two: activation pattern on a layer dictates the breakpoints of piecewise-affine transformations (so the computation) for later layers.
- **A clock is just a way to tell the time** with G. Penington 2024 Spring
 - Resolved **prevalent misconceptions** in the field as a junior graduate student and pioneered **practical applications** of abstract mathematical tools to cosmological modeling.
- **Firewalls at exponentially late times** with A. Blommaert and Y. Nomura 2024 Spring
 - Tackled an ambitious theoretical challenge by developing **toy models** and **rigorous partial progress**, establishing a mathematical framework for future research
- **Geometry and entanglement in AdS/CFT and beyond** 2022 Spring
 - Conducted **independently** and received the best senior thesis Award in Theoretical Physics from MIT.
- **Edge of 2+1D fermionic topo. orders** with X.G Wen 2022 Spring
 - Successfully tackled a neglected, complex theoretical physics problem by **translating it into algorithmic codes** as an undergraduate.

Honors and Awards

- **Invitation talk** at the seminar “Information, Geometry and Physics Seminar,” Caltech 2024
- **Invitation talk** at the workshop “New ideas for old black holes,” UC Berkeley 2024
- **Morse/Orloff Research Award** for my best senior thesis in theoretical physics, MIT 2022
- **Gold medal** in International Physics Olympiad (IPhO). 2018
- **Silver medal (first place)** in Asian Physics Olympiad (APhO). 2018

References

Prof. Hong Liu MIT E-mail: hong.liu@mit.edu	Prof. Geoff Penington Berkeley E-mail: geoffp@berkeley.edu	Prof. Yasunori Nomura Berkeley E-mail: ynomura@berkeley.edu
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