

# Caleb Geren

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## Research interests

Blockchain systems, Zero-knowledge proof systems, Applied cryptography

## Education

2021 – 2025 **Lehigh University** – Bethlehem, PA

B.S. in Computer Science

B.A. in Mathematics

*Cumulative GPA: 3.68, In Major: 3.87*

### Selected coursework

- *Computer Science*: Operating Systems, Blockchain Systems, Projects in Blockchain Technology, Database Systems, Theory of Computation, Parallel Computing (Spring '25), Programming Languages (Spring '25)
- *Mathematics*: Algorithms, Linear Algebra, Graph Theory, Linear Methods, Discrete Structures, Algebra, Probability, Analysis, Statistics (Spring '25)

## Publications

2024 **Blockchain for Large Language Model Security and Safety: A Holistic Survey**

**Caleb Geren**, Amanda Board, Gaby G. Dagher, Tim Andersen, Jun Zhuang

*To Appear: Special Interest Group on Knowledge Discovery in Data (SIGKDD)*

2023 **Scaling Zero-knowledge to Verifiable Databases**

Tal Derei, Benjamin Aulenbach, Victor Carolino, **Caleb Geren**, Michael Kaufman, Jonathan Klein, Rishad Islam Shanto, Henry F. Korth.

*Proceedings of the 1st Workshop on Verifiable Database Systems*

## Honors and scholarships

2024 Boise State University Blockchain REU (BREU; [BREU Site](#))

*REU fellowship which provided me with the opportunity to develop blockchain research concerning large language model applications.*

2023 DAAD Rise Scholarship Recipient (DAAD; [RISE Website](#))

*International scholarship which pairs undergraduate students from North America, Great Britain, and Ireland with faculty at German universities for summer research.*

2023 Mountaintop Summer Experience Fellowship (Lehigh University)

*Competitive fellowship which provides funding for Lehigh undergraduate and graduate students to conduct summer research with faculty.*

## Research experience

Dec 2022 – Present	<b>Lehigh University Blockchain Lab</b> Mentor: Professor Henry F. Korth	<i>Accelerating zk-SNARKs on GPUs</i>
	<ul style="list-style-type: none"><li>– Collaborating with other students in an attempt to parallelize the zk-SNARK proving system Plonk in order to scale zero-knowledge systems generally.</li><li>– Preliminary results from existing Plonk implementations resulted in a publication (see Publications), with another publication expected by Spring '25 detailing specific critical bottlenecks within Plonk's MSM computation in regards to memory congestion between host and device.</li></ul>	
Jan 2024 – Present	<b>Lehigh University Scalable Systems Software Lab</b> Mentor: Professor Arielle Carr	<i>Recycling Search Spaces</i>
	<ul style="list-style-type: none"><li>– In conjunction with other students, more efficient estimations for calculating Krylov subspaces used in approximating PDEs are being developed.</li><li>– Initial results exploring the implementation of a parallel SVD solver failed to approximate solutions, and as such we are now working with neural networks to better ascertain such solutions.</li></ul>	
May 2024 - July 2024	<b>Boise State University Blockchain REU</b> Mentor: Professor Gaby Dagher	<i>Blockchain for LLMs: A Survey</i>
	<ul style="list-style-type: none"><li>– A thorough exploration into the complementary nature of blockchain in the realm of large language model safety and security was conducted.</li><li>– Resulted in a first author publication to appear in SIGKDD Explorations, with much of the drafting, outline, and research questions developed independently.</li></ul>	
Upcoming Spring 2025	<b>ZKM Research Internship</b> Mentor: Professor Jeroen van de Graaf	
	<ul style="list-style-type: none"><li>– I will join the ZKM team as a cryptographic research intern starting in January 2025 where I will work with Dr. Jeroen van de Graaf in better securing and scaling the various cryptographic systems which ZKM relies upon.</li></ul>	

## Teaching experience

Fall 2023	<b>Teaching assistant, CSE 242: Blockchain Systems (Lehigh University)</b>
Fall 2024	Delivered a lecture on the details of the Plonk proving system (see Talks and Posters), as well as held office hours and graded assignments on a weekly basis.
Spring 2024	<b>Teaching assistant, CSE 340: Algorithms (Lehigh University)</b> Held twice weekly office hours reviewing homework assignments, course content, and grading assignments.

## Talks and Posters

- August 2024 **Poster: Integrating Blockchain with LLMs: Towards a Secure and Safe Technology**  
*Poster given at the Idaho Conference for Undergraduate Research (ICUR).*
- November 2023 **Lecture: An In-Depth Look at the Plonk Zero-knowledge Proving System: Plonk By Hand**  
*Lecture delivered in the Blockchain Systems course covering the details of the zk-SNARK construction Plonk.*
- August 2023 **Poster: Blockchain Systems and Applications Research**  
*Presentation given at the Mountaintop Summer Experience Research Fellowship.*
- April 2023 **Poster: Scaling Zero-Knowledge Proof Generation for Large Blockchain Applications**  
*Presented to Lehigh University's internal I-DISC conference.*

## Technical skills

**Programming languages;** C++, Python, Java, CUDA and Thrust CUDA Framework, C, Solidity, Noir, Rust

**Software;**  $\text{\LaTeX}$ , Git

## Other interests

Rock climbing, Surfing, Woodworking, Backpacking, Snowboarding