

SAWYER JACK ROBERTSON

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BIO

I am currently a mathematics Ph.D. student at UC San Diego. My research interests are generally at the intersection of graph theory and data science; including but not limited to spectral graph theory, optimal transport, geometric graph theory, random graphs, and connection Laplacians.

EDUCATION

<b>Ph.D. in Mathematics</b> ( <i>in progress</i> ) University of California, San Diego	2020 - 2026
Advisor: Alex Cloninger	
<b>M.A. in Applied Mathematics</b> University of California, San Diego	2020 - 2022
<b>B.S. in Mathematics</b> , <i>summa cum laude</i> University of Oklahoma	2016 - 2020
Advisor: Javier Alejandro Chávez-Domínguez	
Honors thesis: <i>Analysis on Magnetic Graphs</i>	

ACADEMIC ROLES

<b>Graduate Student Researcher</b>	Jun 2021 - Present
Department of Mathematics and Halicioğlu Data Science Institute, UC San Diego	
• Research focus: Applied graph theory	
<b>Teaching Assistant</b>	Oct 2020 - Present
Math Department, UC San Diego	
• Selected for the lead TA team for the Math Department	Sept 2022
• Courses taught: mathematical statistics, probability theory, graph theory & algorithms, multivariable calculus	
<b>Undergraduate Academic Assistant</b>	Aug 2016 - May 2020
Math Department, University of Oklahoma	

ACCOMPLISHMENTS

• Carol and George Lattimer Award for Graduate Excellence	March 2025
• Selected for Summer Graduate Teaching Scholars	December 2024
• Financial Director, Mathematics Graduate Student Council	July 2024 - July 2025
• Served as Chair of the Mathematics Graduate Student Council	July 2023 - June 2024
• Founded Data, Optimization, Graphs, Signal Processing, Optimal Transport seminar	Oct 2023
• Halicioğlu Data Science Institute Graduate Prize Fellowship	Oct 2020-present
• Samuel Watson Reaves Award for Outstanding Senior Math Major, University of Oklahoma	May 2020
• Undergraduate Research Award, University of Oklahoma Libraries	May 2019

SELECTED RESEARCH

1. Stochastically Evolving Graphs via Edit Semigroups.	Sept 2025
<i>with F Chung</i>	<a href="https://arxiv.org/abs/2509.19678">arxiv.org/abs/2509.19678</a> .

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2. Discrete Curvatures and Convex Polytopes. Sept 2025  
*with J A De Loera, J Samper, J Eddy* In preparation.  


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3. Robust Tangent Space Estimation via Laplacian Eigenvector Gradient Orthogonalization. Sept 2025  
*with D Kohli, G Mishne, A Cloninger* In preparation.  


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4. Robust Graph-Based Semi-Supervised Learning via  $p$ -Conductances. Jan 2025  
*with C Holtz, G Mishne, A Cloninger* [arxiv.org/abs/2502.08873](https://arxiv.org/abs/2502.08873)  


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5. Matrix Concentration for Random Signed Graphs and Community Recovery  
in the Signed Stochastic Block Model. Dec 2024  
[arxiv.org/abs/2412.20620](https://arxiv.org/abs/2412.20620)  


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6. On Discrete Curvatures of Trees. Dec 2024  
[arxiv.org/abs/2412.20661](https://arxiv.org/abs/2412.20661)  


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7. All You Need is Resistance: On the Equivalence of Effective Resistance and  
Certain Optimal Transport Problems on Graphs. Apr 2024  
*with Z Wan, A Cloninger* [arxiv.org/abs/2404.15261](https://arxiv.org/abs/2404.15261)  


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8. On a Generalization of Wasserstein Distance and the Beckmann Problem to Connection Graphs. Dec 2023  
*with D Kohli, G Mishne, A Cloninger* To appear, SIAM J. Sci. Comput.  


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8. Random Walks, Conductance, and Resistance for the Connection Graph Laplacian. Aug 2023  
*with A Cloninger, G Mishne, A Oslandsbotn, Z Wan, Y Wang* SIAM J. Matrix Anal. Appl 45 (3)  


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10. Harnack Inequality for Magnetic Graphs. Oct 2019  
[arxiv.org/abs/1910.04019](https://arxiv.org/abs/1910.04019)

## STUDENTS

Paola Campos	Undergraduate mentee, Summer 2024 - Summer 2025
Ph.D. Student, Mathematics, UC Davis	
Huiwen Lu	Undergraduate mentee, Summer 2022
Ph.D. student, Applied Math, Caltech	

## SELECTED TALKS AND WORKSHOPS

SIAM Pacific Northwest Biennial Meeting, Invited talk	Seattle, WA Oct 2025
Local Limits of Random Graphs Summer School	Orsay, France Jun 2025
UC Davis Math of Data and Decisions Seminar	Davis, CA Jun 2024
Networks Journal Club, UCLA	Los Angeles, CA Jun 2024
SIAM Discrete Mathematics, Beyond Graphs	Spokane, WA Jul 2024
Joint Math Meetings AMS Special Session on Graph Curvature	San Francisco, CA Jan 2024
Optimal Transport Summer School	Seattle, WA Jun 2022
Joint Math Meetings AMS Special Session on Combinatorics and Graph Theory III	Denver, CO Jan 2020

Joint Math Meetings AMS Session on Optics and Electromagnetism

Presented poster Undergraduate Math Symposium at UIC

MAA MathFest

CeSMUR Conference

Baltimore, MD Jan 2019

Chicago, IL Nov 2018

Denver, CO Aug 2018

Lincoln, NE Apr 2018