Mauricio Montes

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Education

Auburn University *Aug 2021 – May 2027*
PhD in Pure Mathematics

- Recipient of the Presidential Graduate Research Fellowship, GEM Fellowship, Chateaubriand Fellowship.
- Thesis topic; A sheaf-theoretic perspective on chemical reaction networks
- Currently a visiting researcher at Sorbonne Universite in Paris, France working under Gregoire Sergeant Perthuis on the effects of transformations on sheaves of probability networks.

University of Texas at Austin *Aug 2017 – May 2021*
BS in Pure Mathematics

Publications

Categorical Perspectives on Chemical Reaction Networks Apr 2026
Justin Curry, *Mauricio Montes*
arxiv.org/abs/2604.04919 (arXiv preprint arXiv:2604.04919)

Reduction of Probabilistic Chemical Reaction Networks 2026
Mauricio Montes, Grégoire Sergeant-Perthuis
Accepted at ICML 2026

Experience

Research Fellow *Los Alamos, New Mexico*
Los Alamos National Laboratory *May 2026 – Aug 2026*

- Will join the CNLS (Center for Nonlinear Studies) in the Theoretical Division at Los Alamos National Laboratory.
- Conducting research with Nicholas Lubbers and Yulia Pimonova on information-preserving graphlet compression for uncertainty-aware machine learning, with applications to molecular and social-network data.

Visting researcher *Paris, France*
Sorbonne Universite *Oct 2025 – May 2026*

- Visting researcher at the LQSB (Laboratory of Quantitative Biological Sciences) at Sorbonne University (UPMC)
- Working with Gregoire Sergeant-Perthuis on probablistic graphical models and their connections to chemical reaction networks.

Summer Associate *Washington, DC*
Institute for Defense Analyses (IDA) *May 2025 – Aug 2025*

- Audited Lockheed Martin's F-35 demand-rate model impacting over 40% of sustainment budget and identified methodological issues and data leakage risks.
- Managed large order demand datasets to build an internal sustainment demand model (Crow-AMSAA, Bayesian, ARIMA) in python; backtested across multiple parts with uncertainty quantification.
- Briefed senior leadership on an upcoming ~$1B budget discrepancy; co-authored a memo summarizing readiness and sustainment implications.

Intern *Aracaju, Brazil*
Carmo Energy *June 2021 – Aug 2021*

- Filtered and cleaned databases to assist data transfer of well logs from PetroBras to CarmoEnergy for compliance with the Brazilian National Agency of Petroleum, Natural Gas and Biofuels.

Intern *Quito, Ecuador*
Cuyabeno Petro *June 2019 – Aug 2019*

- Built and ran simulations using Petrel to calculate oil reserves and study the seismological composition of the area.
- Verified inventory reports and compiled documentation of specific wells in Cuyabeno.

Projects

Surface Growth Models with Tetris Pieces *2024*

- https://github.com/chenle02/Simulations_on_Some_Surface_Growth_Models
- Developed Tetris piece function in python with different types of collisions for a software package, this is used in surface growth modeling for physics.
- Wrote code snippets that analyzed topological structure of substrate, demonstrating linear growth in different types of collision environments.
- This work was presented at the AMS Southeastern Sectional Meeting

Markov Chains for Chick Behavior *2024*

- https://github.com/chenle02/ChickMarkovBehavior
- Helped develop a markov chain model in python for modeling chick behavior from video data. This predicted chick behavior from the first 3 days from birth with 68% accuracy and the data was later used in the masters thesis for the agriculture student Ally Jackson at Auburn University.

Cech Complex Growth on the Torus *2025*

- Developed a tool in C++ for creating a Cech complex on a torus and calculating the homology of the associated complex.
- Collaborating with others to now obtain theoretical calculations of homology of the Cech complex using my provided experimental evidence.

Talks and Posters

Auburn Graduate Student Seminar, Oct 2023 - “What is the shape of data?”

Auburn Graduate Student Seminar, March 2025 - “Sheaves and Chemical Reaction Networks”

(Poster) London-Oxford-Paris TDA Seminar, London, Nov 2025 - "Categorical Reductions of Chemical Reaction Networks"

(Poster) SALTO Workshop, Paris-Saclay, Dec 2025 - "A Categorical Perspective on Reductions of Chemical Reaction Networks"

Jornada de Topologia de Datos, Sevilla, Feb 2026 - "Perspectivas Categoricas de Reducciones de Reacciones Quimicas"

(Upcoming) Lifeware Team Ecole Polytechnique, Paris-Saclay, April 2026 - "A Categorical Perspective on Reductions of Chemical Reaction Networks"

Outreach

Directed Reading Program (DRP) *2022 - Present*

- Founded the Directed Reading Program (DRP) at Auburn University and mentored undergraduate students in algebraic geometry, homological algebra, Fourier analysis, and abstract algebra. The program has since mentored 20+ undergraduate students at Auburn.

Topological Data Analysis Reading Group *Fall 2024*

- Cofounded the Topological Data Analysis (TDA) Reading Group at Auburn University alongside Ian Tan. Led the group by delivering lectures and teaching topics in applied algebraic topology to an audience of 10+ participants, fostering interdisciplinary discussion and engagement.

Additional Information

Math interests

- Applied Algebraic Topology, Probability and Stochastic Processes, Applied Category Theory, Graph Theory, Applied Sheaf Theory, Bayesian Inference, Information Geometry and its applications to Machine Learning

Certifications

- NVIDIA Intro to deep learning, NVIDIA Fundamentals of deep learning for multi-GPUs

Languages

- Fluent in Spanish, Conversational German and Portuguese

Work Eligilbility

- Eligble to work in the U.S. with no restrictions. Currently holding a security clearance.

References

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Henry Schenck - hks0015@auburn.edu

Le Chen - lzc0090@auburn.edu

Gregoire Sergeant-Perthuis - gregoireserper@gmail.com