

Arun Suresh

PhD candidate - University of Missouri

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Education

2021 – Now **PhD in Mathematics**

University of Missouri, Columbia, MO, United States

Dissertation: *The Geometry of Second Moments: Signal recovery estimates for Phase Retrieval and MRA problems (Tentative title)*

Advisor: Dr. Dan Edidin

2020 – 2021 **Dual B.S. (Honors) + M.S. in Mathematics - Summa cum Laude**

Georgia State University, Atlanta, GA, United States

Thesis: *The Generators, Relations and Type of the Backelin Semigroup*

Advisor: Dr. Florian Enescu

Research Interests

Applied Mathematics: Applied algebraic geometry and representation theory for inverse problems.

Data Science: Computational Imaging, Topological Data Analysis, Invariant Machine Learning.

Applied Data Science: Dynamic, Spatio-temporal modeling and ML for Biology/Epidemiology.

Exploring: AG in Computer Vision, Polynomial/Semialgebraic n.nets, Markov/Stochastic modeling.

Research Positions

Summer 2025 **Graduate Research Assistant, MU department of mathematics.**

Project: Recovering 3D protein structure from cryo-electron microscopy measurements

Spring 2025 **Project Lead (volunteer), MU Institute of Data Science and Informatics.**

Project: Dynamic Spatiotemporal model to predict CWD infection spread in Kansas.

Summer 2023 **Graduate research assistant, MU department of mathematics.**

Project: The generic crystallographic phase retrieval problem.

Summer 2020 **Graduate research assistant, GSU department of mathematics and statistics.**

Project: Parameter estimation models and neural ODEs.

Fa+Sp 2019 **University assistant, GSU department of mathematics and statistics.**

Project: (Minimal) generators of the presentation ideal of the Backelin semigroup ring.

Publications

- [Prep.] Dan Edidin, **Arun Suresh**. 2025. $O(n)$ Beltway problem with applications to cryo-EM and Euclidean Distance Geometry. *In preparation*
- [Prep.] **Arun Suresh**, Zoe Shanley, Ram K. Raghavan, et al. 2025. The Direction and Rate of Spread of Chronic Wasting Disease via Spatiotemporal modeling. *In preparation*
- JoFoCM Tamir Bendory, Nadav Dym, Dan Edidin, **Arun Suresh**. 2024. A transversality theorem for semi-algebraic sets with application to signal recovery from the second moment and cryo-EM. *Journal of Foundations of Computational Mathematics*
- SIMODS Tamir Bendory, Nadav Dym, Dan Edidin, **Arun Suresh**. 2023. Phase retrieval with semi-algebraic and ReLU neural network priors. *SIAM journal on mathematics of data science*
- Submitted Dan Edidin, **Arun Suresh**. 2023. The generic crystallographic phase retrieval problem. *Journal of Applied and Computational Harmonic Analysis*.
- CiA 2021 Florian Enescu, **Arun Suresh**. 2021. The generators relations and type of the Backelin semigroup. *Communications in Algebra*

Awards and achievements

- Spring 2023 **Huckaba Scholarship in algebra**, University of Missouri.
This award entailed a \$1,200 scholarship prize
- Spring 2023 **Excellence in graduate teaching**, University of Missouri.
This award entailed a \$300 scholarship.
- Fall 2021 **Excellence in qualifying exams - Algebra, Analysis**, University of Missouri.
This award entailed a \$600 scholarship prize
- Spring 2021 **V.V.Lavroff award for exceptional graduate achievements**, GSU.
This award entailed a \$600 scholarship prize.
- Spring 2019 **V.V.Lavroff award for exceptional undergraduate achievements**, GSU.
This award entailed a \$300 scholarship prize.
- Fall 2017 **Kirkland Sattlemeyer Scholarship**, Georgia State Honors College.
Waived \$2000 off the yearly tuition fees for my Junior and Senior years.
- Fall 2016 **Campus Atlanta Scholarship**, Georgia State University.
Waived the out of state portion of my yearly tuition (~\$18000) during my undergraduate enrollment.

Talks and Presentations

Research talks

- Fall 2025 **Math and Data Seminar, U. of Missouri.**
Title: Recovery of point configuration from unlabeled inter-point distances.
- Fall 2025 **AMS Fall Sectional Conference, St. Louis University.**
Title: $O(n)$ beltway problem with one isolated point.
- Summer 2025 **SIAM conference on Applied Algebraic Geometry, U. of Wisconsin (Madison).**
Title: Phase Retrieval for Signals that are Sparse Under a Generic Orthonormal Basis
- Summer 2023 **Codes and Expansion (CodEx), Online.**
Title: The generic crystallographic phase retrieval problem
- Spring 2023 **Commutative Algebra Regional Expository Seminar (CARES), Online.**
Title: Betti numbers of the Backelin semigroup
- Spring 2023 **Pre-print seminar, MU department of mathematics.**
Title: Exploring the Backelin semigroup
- Spring 2020 **MathNexus - student body at ISI, Online.**
Title: The generators, relations and type of the Backelin semigroup
- Fall 2019 **Georgia Undergraduate Research Conference, University of North Georgia.**
Title: The minimal generating set for the presentation ideal of the Backelin semigroup ring.
- Spring 2018 **GSU algebra seminar, Georgia State University.**
Title: On the number of generators for the presentation ideal of a semigroup ring.

Co-curricular and outreach talks

- Fall 2025 **Graduate Student Seminar, MU Department of Mathematics.**
A primer on Euclidean Distance Geometry with unlabeled distances
- Summer 2023 **GSU-MathPath workshop for undergraduates, Online.**
A workshop on the peer-review process
- Fall 2022 **Graduate student seminar, MU department of mathematics.**
Title: All the money in the world cannot buy me 151 chicken McNuggets*
- Fall 2022 **Pre-print seminar, MU department of mathematics.**
Title: Every algebraic set in n -space is the intersection of n -hypersurfaces
- Spring 2022 **GSU Mathematics and Statistics Undergraduate research conference, Online.**
Title: The art of reasoning: why it is meaningful to pursue a graduate degree in mathematics
- Spring 2020 **Mathematical music composition workshop, Perimeter college.**
Title: La-Pendu: An exploration of neo-Riemannian transformations and Euclidean rhythms.
Original music composition: La-Pendu
- Spring 2019 **Mathematical music composition workshop, Georgia State University.**
Title: Neo-Riemannian transformations and Sierpinski-like walks across the Tonnetz.
Original music composition: Spring

Posters

- Fall 2023 **Western Algebraic Geometry Symposium, Washington University.**
Title: Second moment of dihedral actions, incidence varieties and ensuring signal recovery
- Summer 2020 **eCARs conference, Online.**
Betti-sequence for the Backelin semigroup
- Spring 2019 **Georgia State Undergraduate Research Conference, Georgia State University.**
Title: Numerical semigroup rings and the Frobenius coin exchange problem
- Fall 2018 **Georgia Undergraduate Research Conference, University of North Georgia.**
Title: On the existence of arbitrarily large number of generators for the presentation ideal of semigroup rings
- Fall 2018 **Undergraduate Math Symposium, University of Illinois, Chicago.**
Title: On the minimal number of relations among the generators of the Backelin semigroup

Mentorship

2023 - Now **Directed Readings Program at MU, Founder, Coordinator, Mentor.**

Fall 2025: *Principal Component Analysis with appl. to epidemiology (CWD prediction)*
—**Mentee:** Sevara Pulatova (Sophomore at Mizzou)

Spring 2025: *Linear, Logistic and Generalized regression models*
—**Mentee:** Catriana Boul (Junior at Mizzou)

Fall 2024: *Stochastic Processes and Markov Chains (with appl. in biology)*
—**Mentee:** Zoe Shanley (applying to grad schools.)

Spring 2024: *ML for ODE parameter estimation via the genetic algorithm*
—**Mentee:** Vaso Micheas (now applied math PhD student at Texas A & M)

Spring 2024: *Neural networks and the universal approximation theorem.*
—**Mentee:** Jake Parmentier (now applied math PhD student at CU Boulder)

Fall 2023: *Understanding fiber bundles by visualizing Spec(\mathbb{Z})*
—**Mentee:** Logan Chambers (now Physics PhD student at Montana State)

Spring 2023: *Picturing rings - exploring the marriage b/w algebra and geom.*
—**Mentee:** James Mc. Millen (now Physics PhD student at Northeastern)

Spring 2025 **MU Institute of Data Science and Informatics, Project Lead (Volunteer).**
Modelling the spatio-temporal spread of Chronic Wasting Disease in Kansas using data using data-driven parameter estimation for a spatially augmented dynamical system.
— **Mentee:** Zoe Shanley.

Teaching

- 2021 - Now **University of Missouri**, *Graduate Teaching Assistant.*
Teaching:
Fall 2024 - Fall 2025: Math 1700, Calculus and analytic geometry 2 (Recitations)
Fall 2023 - Fall 2024: Math 1500, Calculus and analytic geometry 1 (Recitations)
Fall 2023: Math 1500H, Calculus and analytic geometry 1 - Honors (Recitations)
Spring 2023: Math 1400, Calculus for social and life sciences
Fall 2022: Math 1300, Finite mathematics
Fall 2021 - Summer 2022: Math 1100, College algebra

Grading:

Fall 2021 - Spring 2023: Math 3000, Introduction to advanced mathematics.

- 2020-2021 **Georgia State University**, *Graduate teaching assistant.*

Teaching:

Fall 2020 - Spring 2021: Math 1111, College algebra

- 2017-2020 **Mathematics Assistance complex (MAC) at GSU**, *Graduate lab assistant.*

Positions:

Spring 2020: Graduate Lab Assistant

2018-2019: University Assistant

2017: Undergraduate student assistant

Classes tutored:

All undergraduate math courses offered (MATH 1001-6752), barring those that required a statistics or bio-informatics concentration.

- Summer 2017 **IIT-Buds Private Ltd.**, *RMO coach.*

Prepared students towards regional mathematics olympiad.

Extra Curricular

- 2023 - Now **Directed Readings Program (DRP) at MU**, *Founder, mentor.*
- 2022 - 2024 **American mathematical society - MU graduate student chapter**, *President.*
- 2022 - 2023 **(Student led) MU algebraic geometry reading group**, *Coordinator, presenter.*
- 2022 - Now **MU mathematics graduate student seminar**, *Co-coordinator.*
- 2018 - 2021 **GSU Continuum group (Putnam team)**, *Founder, member.*
- 2018 - 2021 **Mathematics and Statistics club at GSU**, *President.*
- Summer 2016 **Org. for the promotion of science (Chennai, TN, India)**, *Speaker, member.*

Skills

Programming: Python, Matlab, Julia, Macaulay2, R, C++, Haskell (beginner).

Languages: English, Tamil, L^AT_EX.

Certificates

- Spring 2024 Advanced Google Data Analytics certificate, *Google (via Coursera) online.*
Spring 2023 Google Data Analytics certificate, *Google (via Coursera) online.*
Fall 2023 Advanced Learning Algorithms, *DeepLearning.ai, Stanford online.*

Selected Personal Projects

- Spring 2025 **Modelling the spatio-temporal spread of Chronic Wasting Disease in Kansas, University of Missouri.**
Mentored undergraduate student research project to address the spatio-temporal inconsistencies in CWD prevalence data using parameter estimation for a spatially augmented dynamical system. Built a predictive **mathematical model** with **87.4% accuracy** using geospatial+ML tools. Applied PCA to infection co-variate data, training a random forest classifier that **improved classification accuracy to 93%**
- Fall 2024 **Topological Machine Learning Pipeline for Dimension Reduction, University of Missouri.**
Built an ML pipeline in Python (Torch, Giotto) using persistent homology data of point clouds to **downscale input feature size by 90%**. Trained a **random forest classifier** with topological features for regression and classification tasks, achieving comparable performance to industry standard, with an **out-of-bag score of 100% on synthetic data** and **82.5% on real-world data**.
- Spring 2024 **Simultaneous Robust Subspace Recovery via Quiver representation Theory, University of Missouri.**
Implemented a python package that employs simultaneous robust subspace recovery for dimension reduction. The SRSR scheme effectively extracts a dominant low-dimensional linear subspace contained in a high-dimensional point cloud while minimizing the loss of statistical properties of the original point-cloud.
- Spring 2024 **Optimizing Solar Practicality Across the U.S., Google - Data Analytics Certificate.**
Built a solar feasibility model on **1M+ records**, identifying 3 key metrics to evaluate solar potential across 40K+ ZIP codes. Developed an **R-based ETL pipeline** to integrate geospatial, cost, and energy data, reducing noise by ~60% and identifying solar hot-spots at state/zip levels - suggesting avenues **sustainable environmental developments**. Launched a **Tableau dashboard** with dynamic parameter tuning, visualizing ROI trade-offs and demonstrating > 15K metric tons CO₂ offset and \$6M+ annual savings in electricity per zip-locality.
- Fall 2020 **Numerical analysis research group (Mentor: Dr. Xiaojing Ye), Georgia State University.**
Built a compressed sensing pipeline in Julia with **accelerated proximal gradient optimizer** to improve reception and transmission of **sparse signals**. Implemented a sparsification layer utilizing **Wavelet transforms** (FFT, Wavelets.jl) to handle non-sparse signals. **Delivered a 4× speed-up** to traditional CS methods, while also maintaining the **average error rate below 1%**.

Spring 2020 **Numeripy**, *Online*.

Developed a Python package that offers a comprehensive suite of **20+ numerical methods** including 12 robust differential equation solvers and 9 advanced matrix algebra tools. Garnered significant adoption with an average of **60 downloads per month** and over **6,035 total downloads** to date.

Spring 2019 **Identifying financial bubbles via Nucleation Theory**, *Georgia State University*.

Built a model to **detect market bubbles across 4 financial sectors** by adapting Avrami-JMAK equations from physical nucleation theory. Fitted the adapted model using non-linear LS regression to the 2007 housing bubble data, and **identified scale-invariant indicators** predicting the formation of market bubbles **with 88% accuracy** across four economic sectors.

Fall 2018 **Physics4500 - Computational fluid dynamics**, *Georgia State University*.

Simulated the gravitational collapse of a Spherical Magnetic Molecular Cloud Core With ENZO AMR MHD Code. Used GSU's supercomputer cluster "Harlow" for **parallel computing support**.

References available upon request.