Andrew J. Graven

PhD Candidate · Mathematics · Caltech

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Research Interests

Complex analysis, geometric function theory, and dynamical systems theory, with a focus on inverse problems, potential theory, and complex dynamics. In particular: quadrature domains (and their generalizations), moment problems, free boundary problems (e.g. Hele-Shaw flow & Saffman-Taylor phenomena), transcendental & antiholomorphic dynamics, and ergodic theory.

Education

California Institute of Technology *Pasadena, CA*

Mathematics PhD *2021-2026 (expected)*

- Advisor: Nikolai G. Makarov

Cornell University *Ithaca, NY*

Mathematics BA *2017-2021*

- Summa cum laude
- Distinction in all subjects
- Research Advisor: John H. Hubbard

Awards, Fellowships & Grants

2025	**S. R. Johnson Prize for Excellence in Graduate Study**, Caltech Department of Mathematics	*$1,000*
2023	**NDSEG Exemplary Mathematics Poster Presentation**, US Department of Defense	
2021-2024	**NDSEG Graduate Research Fellowship**, US Department of Defense	*$42,200/yr*
2018-2020	**Summer Undergraduate Research Fellowship (SURF)**, Caltech/JPL	*$7,000/yr*

Publications and Preprints

Published

Andrew J. Graven and John H. Hubbard. *An Elementary Proof of Poincaré's Last Geometric Theorem*. Pro Mathematica, Vol. 31, No. 62, Feb. 2021, pp. 61-93.

Andrew J. Graven, Alan H. Barr, and Martin W. Lo. AAS 21-222: *A Rapid Method for Orbital Coverage Statistics With J_2 Using Ergodic Theory*. AAS Space Flight Mechanics Meeting, 2021.

Leo Huang, Andrew J. Graven and David Bindel. *Density of States Graph Kernels*. SIAM International Conference on Data Mining, April 2021.

Andrew J. Graven and Martin W. Lo. AAS 19-681: *The Long-Term Forecast of Station View Periods for Elliptical Orbits*. Astrodynamics Specialist Conference, Portland, ME, Aug 2019.

Preprints

Andrew J. Graven and Nikolai G. Makarov. *Quadrature Domains and the Faber Transform*. arXiv:2509.03777, Sept. 2025.

Under Preparation

Andrew J. Graven. *Analysis of Log-Weighted Quadrature Domains*, 2025

Andrew J. Graven, Nikolai G. Makarov. *Abelian Quadrature Domains and Saffman-Taylor Phenomena*, 2025

Andrew J. Graven. *On the Coefficients of Conformal Mappings of Quadratic Julia Sets* (expository)

Presentations

** presenting author*

Invited Talks

Andrew J. Graven* May 2024. *Generalized Quadrature Domains with Connections to Hele-Shaw Flow*. Random Matrices and Related Topics in Jeju.

Conference Presentations

Andrew J. Graven* August 2024. *Uniqueness Problems for Generalized Quadrature Domains*. 35th International Workshop on Operator Theory and its Applications, University of Kent.

Andrew J. Graven* August 2023. An Ergodic Approach to Rapid Constellation Design, Coverage Analysis and Collision Risk Assessment. DOD NDSEG Fellowship Conference, San Antonio, TX.

Andrew J. Graven*, Alan H. Barr, and Martin W. Lo. August 2021. A Rapid Method for Orbital Coverage Statistics With J_2 Using Ergodic Theory. AAS Space Flight Mechanics Meeting, Virtual.

Andrew J. Graven* and Martin W. Lo. August 2019. The Long-Term Forecast of Station View Periods for Elliptical Orbits. Astrodynamics Specialist Conference, Portland, ME.

Teaching Experience

Fall 2025	**Ma 110A: Measure Theory, Functional Analysis**, Head TA	*Caltech*
Spring 2025	**Ma 110C: Analysis, Distribution Theory, Operator Theory**, Head TA	*Caltech*
Winter 2024	**Ma 108B: Classical Analysis**, Head TA	*Caltech*
Fall 2024	**Ma 142A: Ordinary and Partial Differential Equations**, Head TA	*Caltech*