

Natanael S. Alpay

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Education

University of California, Irvine

2022–2026/27

Ph.D. in Mathematics, Ph.D. Candidate

Master of Science in Applied Mathematics, 2022–2025

Chapman University

2017–2022

Bachelor of Science in Mathematics

Bachelor of Science in Physics

Bachelor of Arts in French

Bachelor of Science in Computer Science

Certificate

Northeast Big Data Innovation Hub and NSDC

Jan 2025

Training in data cleaning, Python, time series and geospatial analysis, and data visualization.

Academic Appointments and Work Experience

Undergraduate Research Lead

April 2025–Present

Guide undergraduate students on a research project studying high-dimension vectors reduction.

Research Assistant

Sep 2022–Present

Research assistant focusing on pure and applied mathematics at UCI.

Teaching Assistant

Sep 2022–Present

Teaching assistant for calculus, real/complex analysis, machine-learning and related mathematics courses at UCI.

Mentor

Jan 2025–Jun 2025

Data analysis mentor at DATA@UCI for an undergraduate research project at UCI.

Research Assistant

Jun 2022–Aug 2022

Research assistant implementing machine learning algorithms at Chapman University.

Student Assistant

2018–Dec 2021

Student assistant and grader for calculus at Chapman University.

Tutor

Sep 2019–May 2022

Tutor in mathematics, physics, French, and computer science at Chapman University.

Supplementary Instructor (SI)

Sep 2020–May 2022

Supplementary Instructor for Calculus II (Math 111) at Chapman University.

Student Undergraduate Research Assistant

2021

Mathematics Department, Chapman University.

Research Publications

- April 25, 2026. Alpay, Natanael, and Emeric Battaglia. *Complex SGD and Directional Bias in*

Reproducing Kernel Hilbert Spaces. arXivpreprintarXiv:2604.23017.

- April 23, 2026. Alpay, Natanael, Antonino De Martino, and Kamal Diki. *Representer Theorem in Complex Reproducing Kernel Hilbert Spaces with Applications to Fock and Hardy Spaces and Superoscillations*. arXivpreprintarXiv:2604.22165.
- Jan 16, 2026. Natanael Alpay. *Fractional Supershifts and Their Associated Cauchy Evolution Problems*. Submitted. <https://arxiv.org/abs/2601.11829>
- Feb 1, 2025. Natanael Alpay and Paata Ivanisvili. *Lower Bounds for Dyadic Square Functions of Indicator Functions of Sets*. Submitted. <https://arxiv.org/abs/2502.16045>
- Mar 2025. Natanael Alpay, Antonino De Martino, and Kamal Diki. *The Fueter Mittag-Leffler Bargmann Transform*. <https://www.sciencedirect.com/science/article/pii/S0022247X25002616>
- Jan 2025. Natanael Alpay and Tiju Cherian John. *Thermal States on Mittag-Leffler Fock Space of the Slitted Plane*. <https://www.sciencedirect.com/science/article/pii/S0022247X25000952>
- Nov 2023. Natanael Alpay and Kamal Diki. *On the Mittag-Leffler Bargmann (MLB) Transform*. <https://www.sciencedirect.com/science/article/pii/S0022247X23004614?via%3Dihub>
- Feb 2022. Natanael Alpay, P. Cerejeiras, and U. Kähler. *Generalized Fock Space and Fractional Derivatives with Applications to Uniqueness of Sampling and Interpolation Sets*. Submitted. <https://arxiv.org/abs/2112.07883>
- Mar 2023. Natanael Alpay. *A New Characterization of the Hardy Space and of Other Spaces of Analytic Functions*. <https://iupress.istanbul.edu.tr/en/journal/ijmath/article/a-new-characterization-of-the-hardy-space-and-of-other-hilbert-spaces-of-analytic-functions>
- 2021. Natanael Alpay, P. Jipsen, and M. Sugimoto. *Unary-Determined Distributive ℓ -magmas and Bunched Implication Algebras*. https://link.springer.com/chapter/10.1007/978-3-030-88701-8_2
- Jan 2020. Natanael Alpay and P. Jipsen. *Commutative Doubly-Idempotent Semirings Determined by Chains and by Preorder Forests*. https://link.springer.com/chapter/10.1007/978-3-030-43520-2_1

Awards and Honors

NSF Travel Support Grant

Jun 2025

NSF travel grant for the 36th International Workshop on Operator Theory and its Applications, University of Twente, July 14–18, 2025.

Ronald M. Huntington Outstanding Scholarship Award

May 2022

Award presented to the graduating senior judged to have exhibited the most distinguished record of scholarly accomplishment at Chapman University. Reference: <https://blogs.chapman.edu/engineering/2022/05/11/fowler-school-of-engineering-student-receives-ronald-m-huntington-outstanding-scholarship-award-at-2022-campus-leadership-awards/>

Outstanding Mathematics Student Honors

May 2022

Honors award for the outstanding mathematics student in the graduating class of Schmid College of Science and Technology.

Outstanding Physics Student Honors

May 2022

Honors award for the outstanding physics student in the graduating class of Schmid College of Science and Technology.

Undergraduate Scholarly/Creative Grant

Apr 2020

Received for the research project *The Structure of Distributive Idempotent Weakly Conservative Lattice-Ordered Magmas*.

Summer Undergraduate Research Fellow (SURF) Award

Apr 8, 2020

Selected as a fellowship recipient for Chapman University's Summer Undergraduate Research Fellowship for the project *Differential Forms as Tools in Differential Geometry and Analysis on Manifolds*.

Undergraduate Scholarly/Creative Grant

Jun 2019

Received for the research project *Commutative Doubly-Idempotent Semirings Determined by Chains and by Preorder Forests*.

DataFest First Place and Best Insight Award

May 2019

First Place and Best Insight awards at DataFest 2019 (team *git rekt*), Chapman University.

Research Talks

- Aug 3, 2026. **International Workshop on Operator Theory and its Applications (IWOTA 2026)**. Upcoming invited talk.
- Apr 29, 2026. **Pediatric and Lifespan Data Science Conference**. *Integrating Machine Learning for VAERS Vaccine Safety Signal Triage vs. Classical Disproportionality: A Pediatric and Lifespan Evaluation*.
- Jan 23, 2026. **Biostatistics Symposium of Southern California 2026**. *Integrating Machine Learning for Pharmacovigilance Adverse Event Signal Detection Compared to Classical Disproportionality*.
- Jan 16, 2026. **Workshop on Applications of Hypercomplex Analysis 2026**. *Fractional Supershifts and Their Associated Cauchy Evolution Problems*.
- Jan 5, 2026. **JMM 2026**. *Lower Bounds for Dyadic Square Functions of Indicator Functions of Sets*.
- Jan 4, 2026. **JMM 2026**. *The Mittag-Leffler Bargmann Transform and Its Extension to the Hypercomplex Setting*.
- Jul 18, 2025. **International Workshop on Operator Theory and its Applications (IWOTA 2025)**. *Thermal States on Mittag-Leffler Fock Space of the Slitted Plane*.
- Jul 18, 2025. **International Workshop on Operator Theory and its Applications (IWOTA 2025)**. *The Mittag-Leffler Bargmann Transform and Its Extension to the Quaternionic Setting*.
- Apr 26, 2025. **Southern California Applied Mathematics Symposium**. *Special Functions as Solutions to Least-Squares Problems*.
- Mar 28, 2025. **22nd Annual Workshop on Applications and Generalizations of Complex Analysis**. *Lower Bounds for Dyadic Square Functions of Indicator Functions of Sets*.
- Mar 20, 2025. **Mathematics of Data, Dynamics, and Life Sciences**. *On the Complex Representer Theorem and Applications to Minimization Problems*.
- Nov 19, 2024. **Advances in Operator Theory with Applications to Mathematical Physics 2025**. *On the Complex Representer Theorem and Applications*.

- Jan 11, 2024. **Workshop on Schur Analysis and Applications to Hypercomplex Analysis, Neural Networks and Linear Systems.** *Thermal States on Mittag-Leffler Fock Space of the Slitted Plane.*
- Jan 4, 2024. **JMM 2024.** *Thermal States on Mittag-Leffler Fock Space of the Slitted Plane.*
- Oct 31, 2023. **Heat Flow, Two-Point Inequalities, and Beyond.** *On Complex Hypercontractivity after S. Janson.*
- Nov 15, 2022. **Advances in Operator Theory with Applications to Mathematical Physics 2022.** *On the Mittag-Leffler Bargmann (MLB) Transform.*
- May 21, 2022. **Workshop on Operator Theory with an Eye on Linear Systems and Hypercomplex Analysis.** *On the Mittag-Leffler Bargmann (MLB) Transform.*
- Nov 20, 2021. **SCCUR 2021.** *Generalized Fock Space Using Fractional Derivatives with Applications to Uniqueness of Sampling and Interpolation Sets.*
- Aug 11, 2021. **IWOTA 2021,** special session on Hilbert Spaces of Analytic Functions and Applications. *Generalized Fock Space and Fractional Derivative.*
- Oct 29, 2020. **18th International Conference on Relational and Algebraic Methods in Computer Science (RAMiCS 2020),** École polytechnique, Palaiseau, France. *Commutative Doubly-Idempotent Semirings Determined by Chains and by Preorder Forests.*
- May 9, 2020. **Chapman Capstone Presentation.** *The Structure of Distributive Idempotent Weakly Conservative Lattice-Ordered Magmas.*
- May 9, 2020. **Chapman Capstone Presentation.** *Minimal Surfaces.*
- Jan 17, 2020. **JMM 2020 National Meeting,** Denver, Colorado, AMS Contributed Paper Session on Algebra and Algebraic Geometry I. *Some Structural Results About Commutative Doubly-Idempotent Semirings.*
- Nov 10, 2019. **AMS 2019 Sectional Meeting,** UC Riverside, Undergraduate Research Special Session. *Some Structural Results About Commutative Doubly-Idempotent Semirings.*

Other Research Projects

Student-Faculty Research and Creative Activity for Course Credit 2021

With Dr. Vajiac. Project title: *The Mathematical Basis of General Relativity.*

Student-Faculty Research and Creative Activity for Course Credit 2021

With Dr. Dressel. Project title: *Quantum Trajectories for Qutrit Processors.*

Mathematical Objects in Virtual Reality 2020–2022

Worked with Dr. Jipsen on representing abstract mathematical objects such as lattices in virtual reality.

Student-Faculty Research and Creative Activity for Course Credit 2020

With Dr. Sebbar. Project title: *Road Map to Zeta ζ and Theta θ .*

Brain Institute Summer 2018

Part of the IRB team for a sensory deprivation float pod experiment and its connection to the placebo effect. Gathered statistics about the safety and health benefits of bikes and e-bikes for a project studying whether they are a viable alternative for commuters.

Attended Workshops

- *Mathematical Foundations of Data Science*, Université de Montréal, May 20–24, 2025.
- *22nd Workshop on Applications and Generalizations of Complex Analysis*, University of Aveiro, Mar 28–29, 2025.
- *Heat Flow, Two-Point Inequalities, and Beyond*, University of California, Irvine, Oct 30–Nov 3, 2023.
- *SYCO 4: Fourth Symposium on Compositional Structures*, Chapman University, May 2019.

Additional Activities and Service

- Helped organize technical details for a mathematics conference, including the abstract book, contacting participants, and preparing name tags.
- Math Club President and former Math Club Vice President at Chapman University.
- Active member of the Physics Club and Philosophy Club.

Posters

- Aug 4, 2021. Schmid Summer Research Showcase at Chapman University. *Machine Learning and Neural Networks: The Theory Behind Implementations*.
- May 6, 2021. Student Symposium at Chapman University. *Quantum Trajectories for Qutrit Processes*.
- May 6, 2021. Student Symposium at Chapman University. *The Mathematical Basis of General Relativity*.
- Nov 27, 2019. Student Scholar Symposium, Chapman University. *Some Structural Results About Commutative Doubly-Idempotent Semirings*.

Additional Skills

- Fluent in French, English, and Hebrew; also speaks Russian and some Arabic.
- Linux user.
- 3D modeling, 3D printing, CNC, and soldering.
- Avid Lego builder.