Kale Stahl

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Education

Kansas State University, Manhattan, KS
B.S. Mathematics
B.S. General Physics
Minor: Computer Science
University Honors Program

Expected: May 2024
Mathematics GPA: 4.00
Cumulative GPA: 3.95

August 2020 - Present

Relevant Coursework

MATH 827: Classical & Modern Fourier Analysis I *Fall 2023*
Textbook: "Fourier Analysis", Duoandikoetxea
Graduate course motivating the Fourier transform on the torus and extending it to maximal functions and Paley-Littlewood Theory. Proved results with singular integrals and the Riesz transform.

MATH 823: Geometric Measure and Function Theory I *Fall 2023*
Textbook: "Fractals in Probability and Analysis", Bishop
Graduate course covering fractals, Hausdorff dimension, self-similar sets, and applications to geometric function theory. Gave a presentation on Sobolev Inequalities and Sobolev embedding as a final presentation.

MATH 821: Real Analysis *Fall 2022*
Textbook: "Real Analysis: Modern Techniques and Their Applications", Folland
Graduate course covering σ-algebras, measure theory, and Lebesgue integration up to L^p spaces and proving the Fubini-Tonelli Theorem.

MATH 716: Applied Math II *Spring 2023*
Textbook: "Introductory Functional Analysis with Applications", Kreyszig
Graduate level course covering Hilbert spaces, Galerkin methods for solving integral equations, generalized functions and distributions, Greens functions, and generalized Fourier transformations.

Research Experience

Kansas State University Department of Mathematics, Manhattan KS

A New Sampling Indicator Functional for Periodic Media *January 2021 - May 2022*

- Advised by Dr. Dinh-Liem Nguyen (Kansas State University) and Dr. Trung Truong (Marshall University)
- Developed a new imaging functional for use with the inverse scattering problem for periodic media
- Verified properties of the functional through rigorous analysis and then used MATLAB to create simulations to verify the behavior numerically
- Published results in the journal "Inverse Problems and Imaging"
- Presented finding through poster presentations and gave a talk at the CeSMUR Conference
- Funded by the Kansas State University Arts and Sciences Research Scholarship

A Generalization of the Funk-Hecke Formula in 3-Dimensions *January 2022 - October 2022*

- Advised by Dr. Dinh-Liem Nguyen (Kansas State University) and Dr. Trung Truong (Marshall University)
- Worked toward finding a generalized for the Funk-Hecke formula in 3-dimensions for use in creating a new imaging functional for inverse scattering problems
- Through a self-lead research project, a generalization was found but only in an implicit form that required iterated integration
- Utilized MATLAB simulations to find numerical approximations for the explicit form
- Future work involves deriving an explicit form from the implicit form found
- Funded by NSF Grants DMS-1812693 and DMS-2208293

Factorization Method for Inverse Scattering *January 2023 - Present*

- Advised by Dr. Dinh-Liem Nguyen (Kansas State University) and Dr. Trung Truong (Marshall University)
- Reading Kirsch and Grinberg's book "The Factorization Method for Inverse Problems" and proved important theorems about the extremely rigorous Factorization method for inverse problems
- Working with ideas on functional analysis including Sobolev spaces, Green's Functions, and operator theory
- Findings will be used as an undergraduate thesis for the University Honors Program
- Funded by NSF Grants DMS-1812693 and DMS-2208293

University of Michigan - Dearborn Department of Mathematics, Dearborn, MI
Edge Detection from Phaseless Measurements   *May 2022 - July 2022*

- Advised by Dr. Aditya Viswanathan and Dr. Yulia Hristova (both Univeristy of Michigan - Dearborn)
- Worked with peers through the UM-Dearborn REU on topics in signal processing, compressive sensing, and numerical analysis
- Developed a method to accurately detect jump discontinuities from phaseless signals
- Presented findings at the SUMMR conference
- Funded by NSF REU Grant

Kansas State University Department of Physics, Manhattan, KS
Bispectrum Measurement from Euclid Telescope Data   *Spring 2023 - Present*

- Advised by Dr. Lado Samushia (Kansas State University)
- Working with data from the Euclid telescope with the goal of determining a window-deconvolution algorithm for the general case of the bispectrum measurement
- Used Python and Julia to analyze true data to test validity of the developed algorithm
- Conducted as a part of the PHYS 707 Research for Credit Course

A Self Study in General Relativity   *August 2022 - Present*

- Self led independent study with questions answered by by Dr. Lado Samushia (Kansas State University)
- Reading through Misner, Thorne, and Wheeler's book "Gravitation" and working through the provided exercises.
- Conducted in lieu of taking a graduate cosmology course to learn general relativity

Publications and Presentations

D.L. Nguyen, **K. Stahl**, and T. Truong. *A new sampling indicator function for stable imaging of periodic scattering media* in Inverse Problems, Volume 39, Number 6, May 9, 2023.
URL: https://iopscience.iop.org/article/10.1088/1361-6420/acce5f/meta

Kansas Honors Connections Conference

- Gave a 10-minute oral presentation entitled "A New Sampling Imaging Functional for Imaging Photonic Crystals" on November 18th, 2023 in Emporia, KS
- Detailed the work seen in the publication with Dr. D.L. Nguyen and Dr. T. Truong on a new stable sampling imaging functional for periodic media and potential extensions to Maxwell's equations

Kansas State Physics Department Undergraduate Colloquium

- Gave a 15-minute oral presentation entitled "A New Sampling Imaging Functional for Imaging Photonic Crystals" on October 30th, 2023 in Manhattan, KS
- Detailed the formulation for the inverse scattering problem and the work seen in the publication with Dr. D.L. Nguyen and Dr. T. Truong on a new stable sampling imaging functional for periodic media

Central States Math Undergraduate Research Conference

- Gave a 15-minute oral presentation entitled "A New Sampling Imaging Functional for Imaging Photonic Crystals" on February 25th, 2023 in Manhattan, KS
- Detailed the work seen in the publication with Dr. D.L. Nguyen and Dr. T. Truong on a new stable sampling imaging functional for periodic media

Office of Undergraduate Research & Creative Inquiry Research Showcase

- Participated in the OURCI Research Showcase with a poster titled "Orthogonality Sampling Method for Periodic Scattering Media" on November 30th, 2022 in Manhattan, KS
- Detailed the foundations of a new sampling imaging functional and the comparisions between it and the Orthogonality Sampling Method

Summer Undergraduate Michigan Mathematics Research Conference

- Gave a group presentation titled "Edge Detection From Phaseless Measurements" on July 15th, 2022 in Dearborn, MI
- Explained the new method developed to extract edges from phaseless measurements

AMS-PME Student Poster Session at the Joint Mathematics Meetings

- Participated in a student poster session at the Joint Mathematics Meeting Virtually on April 8th 2022 with a poster entitled "Orthogonality Sampling Method for Periodic Scattering Media"
- Detailed how the orthogonality sampling method can be modified to perform better numerically on periodic objects

Additional Work Experience

Kansas State University, Manhattan, KS
Undergraduate Teaching Assistant *August 2021 - Present*

- Teaching as an undergraduate teaching assistant and learning assistant through the K-State Physics Department
- Worked as a Teaching Assistant the following courses: The Physical World, Engineering Physics I and Physics 3: Relativity and Quantum
- Facilitated and set up experimental procedures and qualitative problem solving sessions
- Provided feedback on lab and homework

Undergraduate Grader *August 2020 - May 2021*

- Hired as a freshman to grade homework assignments for introductory mathematics classes
- Graded for College Algebra, Trigonometry and Calculus I and II

Other Involvement

Kansas State University Physics Club *August 2020 - Present*

- Served as Vice President from August 2022 to May 2023
- As Vice President served to revive the Physics Club after it dissolved during the Pandemic and was responsible for organizing meetings, working with the department and completing the proper bureaucratic procedures to become an official club
- Served as Activities Coordinator From August 2021 to May 2023
- As activities Coordinator, was responsible for organizing stargazing events, game nights, and physics club associated homework help sessions.

Kansas State University Math Club *August 2020 - Present*

- Attended meetings and seminars organized by the math department
- Competed in mathematical competitions including the Putnam exam and the S. Thomas Parker Memorial Math Competition

Kansas State University Directed Reading Program *September 2020 - January 2021*

- Worked with a graduate student to read Nagy's "Deblurring Images" and apply the text using truncated singular value decomposition to numerically deblur images
- Delivered a 10-minute presentation oral presentation on the material

Awards and Honors

Goldwater Scholarship Campus Nominee *January 2022, January 2023*

- Was selected twice as both a sophomore and junior to represent Kansas State at the national level to compete for the Goldwater scholarship.

Kansas Collegiate Mathematics Competition Second Place Team *April 2022, April 2023*

- Part of the second place team in a mathematical competition for students attending universities in Kansas held at the Kansas MAA meeting in both 2022 and 2023

S. Thomas Parker Competition Honorable Mention *April 2022*

- Received honorable mention in a campus-wide mathematical competition for freshman and sophomore students as a sophomore

Top 34 Percent Putnam Exam *December 2021*

- Placed in the top 34 percent of test takers in the 2021 Putnam exam with a score of 7

S. Thomas Parker Competition Second Place *April 2021*

- Placed second in a campus-wide mathematical competition for freshman and sophomore students as a freshman

Scholarships and Fellowships

S. Thomas Parker Memorial Mathematics Scholarship	*August 2022, August 2023*
Wayne and Ellen Evans Mathematics Scholarship	*August 2020, August 2021*
John P. Giese Memorial Physics Scholarship	*August 2022, August 2023*
Ronald Dee Parks Memorial Physics Scholarship	*August 2022, August 2023*
AB Cardwell Physics Scholarship	*August 2021*
Physics Department Scholarship	*August 2021*
Arts & Sciences Research Scholarship	*January 2021, May 2021*

Technical Skills

- Coding Proficiencies: Python, MATLAB, C#, C++, Java, Julia
- Familiarity with creating numerical simulations for physical phenomena in both Python and MATLAB
- Understanding of statistical tools used in large-scale data analysis in physics