

## Education

*University of California, San Diego*

*June 2023*

- Doctor of Philosophy, Mathematics with Specialization in Computational Science
  - Thesis: *Geometric Variational Integrators for Multisymplectic PDEs and Adjoint Systems*
  - Advisor: Professor Melvin Leok

*University of California, San Diego*

*December 14, 2019*

- Master of Arts, Applied Mathematics

*University of California, San Diego*

*December 16, 2017*

- Bachelor of Science, Physics
- Bachelor of Science, Mathematics
  - Thesis: *Structure Preserving Discretizations of Classical Field Theories*
  - Honors with Highest Distinction
- Magna Cum Laude

## Research Experience

*Graduate Student Researcher, UCSD Center for Computational Mathematics*     *October 2018 – Current*

- Research in constructing and analyzing variational integrators for Lagrangian and Hamiltonian systems, including multisymplectic integrators for field theories and intrinsic variational integrators for adjoint systems with applications to optimization and optimal control
- Advised by Prof. Melvin Leok

*Research Assistant, UCSD Center for Memory and Recording Research*     *June 2017 – September 2018*

- Tested capabilities of degaussing machines for erasing magnetic media, and measuring properties of magnetic materials
- Characterized and operated measurement devices for magnetic recording, including Polar Kerr Magnetometer, Vibrating Sample Magnetometer, Magnetic Field Mapper, and LTO Tape Drives
- Performed statistical analysis and model fitting to match experimental data to theoretical models
- Work funded by the National Security Agency
- Supervised by Dr. Fred Spada

*Research Student, UCSD Center for Computational Mathematics*

*September 2016 – June 2018*

- Studied computational modeling of Classical Field Theories using techniques from Finite Element Exterior Calculus. Focused on creating structure-preserving algorithms to discretize field theories, including developing a Discrete Euler-Lagrange equation and a Discrete Hamilton's equation. Systems modelled include
  - Yang-Mills-Higgs Systems (e.g., Maxwell-Schrodinger System)
  - Maxwell-Vlasov System (via Particle-In-Cell Method)

- Advised by Professor Michael Holst and Professor Melvin Leok

*Research Assistant, UCSD Cosmology Group*

*September 2015 – August 2016*

- Research assistant for the POLAR-BEAR 2 Collaboration for studying CMB Radiation
- Worked on fabricating lenslets for the detector and analyzing error data in lenslet construction to understand output yield
- Supervised by Professor Brian Keating

## **Professional Experience**

*Associate Instructor, UCSD Department of Mathematics*

*June 2021 - Present*

- Instructor for Math 20D: Introduction to Differential Equations
- Instructor for Math 20E: Vector Calculus
- Instructor for Math 20A: Calculus for Science and Engineering I
  - Instructor in the UCSD Summer Bridge Program, which serves as a transition program for first-year students, which prioritizes first-generation students and students from underserved populations. Participation includes pedagogical and course design training, and professional development.

*Teaching Assistant, UCSD Department of Mathematics*

*September 2017 – Present*

- Prepared material (discussion notes, practice exams, review material, homework solutions), led discussions, held office hours and reviews, and proctored/graded exams
  - Math 20B: Calculus for Science and Engineering II
  - Math 20E: Vector Calculus
  - Math 150A: Differential Geometry
  - Math 150B: Calculus on Manifolds
  - Math 179: Projects in Computational and Applied Mathematics

*Workshop Facilitator, UCSD OASIS Learning Center*

*January 2015 – March 2016*

- Independently led quarter-long workshops for students to supplement their learning in class
- Designed lesson plans and presented course material to workshops of 10 to 30 students in size
- Courses facilitated include Math 20C: Multivariable Calculus, Math 20E: Vector Calculus, and Physics 2C: Fluids, Waves, Thermodynamics, and Optics
- Completed a preparatory teaching-methods training course

## **Publications**

- *Geometric Methods for Adjoint Systems* (with M. Leok), Journal of Nonlinear Science, submitted, 2022.
- *Variational Structures in Cochain Projection Based Variational Discretizations of Lagrangian PDEs* (with M. Leok), Journal of Nonlinear Science, submitted, 2022.
- *Multisymplectic Hamiltonian Variational Integrators* (with M. Leok), International Journal of Computer Mathematics (Special Issue on Geometric Numerical Integration, Twenty-Five Years Later), 99(1), 113-157, 2022.

## **Invited Talks**

- *Variational structures in cochain projection based discretization of classical field theories*. ICIAM 2023, Minisymposium on “Finite element complexes for structure-preservation in continuum mechanics”. Waseda University. 2023 (Upcoming).
- *Type II Hamiltonian Lie Group Variational Integrators with Applications to Geometric Adjoint Sensitivity Analysis*. Foundations of Computational Mathematics 2023, Workshop in “Geometric Integration and Computational Mathematics”. Sorbonne University. 2023.

### Talks and Poster Presentations

- *Geometric Integration of Multisymplectic Hamiltonian PDEs*. Trends in Soliton Dynamics and Singularity Formation for Nonlinear Dispersive PDEs. Texas A&M University. 2022.
- *Geometric Methods for Adjoint Systems*. Computational Geometric Mechanics Research Seminar, UCSD. 2022.
- *Geometric Integration of Adjoint DAE Systems*. UCSD Center for Computational Mathematics. 2022.
- *Geometric Methods for Adjoint Systems* (Poster Presentation). Symmetries, Invariants, and their Applications. Dalhousie University. 2022.
- *Adjoint Systems via Dirac Structures*. XVI Young Researchers Workshop in Geometry, Mechanics and Control. Centre de Recerca Matemàtica, UAB. December 2021.
- *Multisymplectic Variational Integrators for Hamiltonian PDEs*. Zoom for Thought Seminar, UCSD Mathematics, November 2021.
- *Variational Discretizations of Lagrangian and Hamiltonian Field Theories*. Advancement to Candidacy, UCSD Mathematics. April 2021.
- *Multisymplectic Hamiltonian Variational Integrators*. UCSD Center for Computational Mathematics Seminar. April 2021.
- *Discrete Multisymplectic and Variational Principles of the FEM in Lagrangian Field Theory*. Center for Computational Mathematics Seminar. December 2020.
- *Structure-Preserving Discretizations of Classical Field Theories*. Center for Computational Mathematics Seminar. February 2019.

### Conferences Attended

- *ICIAM 2023*. Waseda University. 2023 (Upcoming).
- *Foundations of Computational Mathematics 2023*. Sorbonne University. 2023.
- *Trends in Soliton Dynamics and Singularity Formation for Nonlinear Dispersive PDEs*. Texas A&M University. 2022.
- *Symmetries, Invariants, and their Applications (A Celebration of Peter Olver’s 70<sup>th</sup> Birthday)*. Dalhousie University. 2022.
- *Critical Issues in Mathematics Education 2022: Initiating, Sustaining, and Researching Mathematics Department Transformation of Introductory Courses for STEM Majors*. MSRI, Berkeley (Hybrid). 2022.
- *Holistic Design of Time-Dependent PDE Discretizations*. ICERM, Brown University. 2022.
- *XVI Young Researchers Workshop in Geometry, Mechanics and Control*. Centre de Recerca Matemàtica, UAB. 2021.
- *MSRI Summer Graduate School: Gauge Theory in Geometry and Topology*. MSRI, Berkeley (virtual). 2021.
- *Flash GAMP (Geometric Algorithms and Methods in Physics)*. Virtual. 2021.
- *Gone Fishing: Integrable Systems and Group Actions*. Georgia Southern University (virtual). 2020.
- *Structure-Preserving Geometric Discretization of Physical Systems*. Princeton. 2020.

- *Structure Preservation and General Relativity*. University of Cambridge. 2019.
- *Chicago Summer School in Analysis*. University of Chicago. 2016.
- *PIMS – NSF Undergraduate Workshop on Supersymmetry*. University of British Columbia, Vancouver. 2016.

## Grants

- NSF Graduate Research Fellowship – PI – \$138,000 – DGE-2038238 – October 2018-June 2023

## Honors and Awards

*Marc Kac Postdoctoral Fellow in Applied Mathematics – LANL* 2023 – 2025

- The fellow will pursue cutting-edge research in DOE-relevant areas of applied mathematics. Up to one Fellowship will be selected each year, jointly sponsored by the DOE Office of Applied Scientific Computing Research and the Center for Nonlinear Studies. Appointments are for two years and full funding is provided.

*Powell Dissertation Award – UCSD Department of Mathematics* June 2023

*NSF RTG – Center for Computational Mathematics – Funding Recipient* 2022 – 2023

- Graduate student researcher funded under the UCSD Center for Computational Mathematics NSF RTG Award; supervised by grant Co-PI Melvin Leok.

*ARCS Foundation Fellowship* 2021 – 2023

- ARCS Foundation fellowships reward excellence in research. Selection is based primarily on the exceptional promise of the nominee to make a significant contribution to the advancement of science, and to the material and intellectual welfare of all people.

*NSF Graduate Research Fellowship* October 2018 – June 2023

- The NSF GRFP recognizes and supports outstanding graduate students in NSF-supported STEM disciplines at accredited US institutions.

*Shang-Keng Ma Memorial Award* June 2018

- Awarded to a graduating physics student who has shown exceptional ability and promise during their UC San Diego undergraduate years.

*Errett Bishop Scholarship* September 2017

- Awarded to graduating UCSD Mathematics seniors for academic excellence.

*Mathematics Senior Thesis: Honors with Highest Distinction* June 2017

- Presented and defended thesis to Honors Thesis Committee; awarded Highest Distinction.

*Selma and Robert Silagi Award for Undergraduate Excellence* May 2017

- Awarded to the top graduating senior in the UCSD Division of Physical Sciences.

## Leadership and Service

- Created and organized the Computational Geometric Mechanics Research Seminar at the UCSD Center for Computational Mathematics. This is a collaborative research-level seminar where each session, the speaker gives a talk on current research in the field of computational geometric mechanics and subsequently, the speaker moderates a collaborative discussion and problem-solving session pertaining to open problems in the field.
- Participated as an instructor in the UCSD Summer Bridge Program, 2021, which serves as an empowering transition program for incoming first-year students, especially first-generation students and students from underserved populations. Participation involves extensive training for interacting with students and designing a course to meet the mission goals of the Summer Bridge program.
- Served as a workshop facilitator at the UCSD OASIS Learning Center's Math and Science Tutorial Program, to provide academic support to undergraduate students within their coursework. Participation involved training sessions and completing a preparatory pedagogical teaching methods course.

## Coursework

### *Mathematics*

- Analysis, Numerical Analysis, Abstract Algebra, Applied Linear Algebra, Algebraic Topology, Partial Differential Equations, Complex Analysis, Differential Geometry, Lie Groups, Calculus on Manifolds, Numerical PDE, Geometric Methods in Physics, Geometric Mechanics, Geometric Numerical Integration, Computational Topology, Optimization on Manifolds, Representation Theory

### *Physics and Engineering*

- Modern Physics, Classical Mechanics, Electromagnetism, Quantum Mechanics, Quantum Field Theory, Fluid Mechanics, Computational Physics, Thermodynamics, Statistical Mechanics, Astrophysics, General Relativity, Modern Physics Lab, Circuits and Electronics Lab, Condensed Matter Lab, Parallel Computing

## Skills

- *Computation:*
  - Languages: C, MATLAB, Mathematica, Origin, LaTeX, Excel
  - Optimization, Optimal Control, Finite Element Exterior Calculus, Finite Element Analysis, Discrete Exterior Calculus, Computational Topology, Numerical PDE/ODE, Galerkin Method, Symplectic and Variational Integration, Monte Carlo Method, Particle-In-Cell Method, Statistical Regression and Model Fitting
- *Experimentation:*
  - Condensed Matter Techniques: Vibrating Sample Magnetometry, Polar Kerr Magnetometry, Heat Capacity and Thermal Transport measurements, Electrical Transport measurements, Soldering, Elementary Materials synthesis
  - Circuits: Experience designing, implementing, and probing circuits involving active devices, op-amps, field effect transistors, junctions, feedback, logic gates; experience using oscilloscope and signal analyzer

## References

### *Professor Melvin Leok*

- Professor of Mathematics
- Co-Director, CSME Graduate Program
- University of California, San Diego
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### *Professor Albert Chern*

- Assistant Professor of Computer Science and Engineering
- Center of Visual Computing
- University of California, San Diego
- alchern@ucsd.edu

### *Dr. Fred Spada*

- Associate Research Scientist
- Center for Memory and Recording Research
- University of California, San Diego
- fspada@ucsd.edu

### *Professor Michael Holst*

- Distinguished Professor of Mathematics and Physics
- Co-Director, Center for Computational Mathematics
- University of California, San Diego
- mholst@ucsd.edu

### *Professor Jeff Rabin*

- Professor of Mathematics
- MSED Co-Director and Steering Committee Member
- University of California, San Diego
- jrabin@ucsd.edu