

# Kyle Fridberg

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## Education

### HARVARD UNIVERSITY

#### A.B. Candidate in Chemistry & Physics and Mathematics (GPA 3.72/4.00)

Expected May 2023

- Previous coursework: numerical methods, physical mathematics, partial differential equations, vector calculus, linear algebra, probability, complex analysis, real analysis, abstract algebra, physics (quantum mechanics, classical mechanics, wave mechanics, electricity and magnetism), chemistry (organic and inorganic).
- Current coursework: random matrix theory, differential geometry, analytic number theory (auditing).

## Research Experiences

### HARVARD UNIVERSITY

#### Independent Research with Dr. Dusty Grundmeier (September 2020–present)

- Proved convergence of a family of polygonal spirals made of regular  $n$ -gons.
- Delivered oral presentations of my work involving polygonal  $n$ -gon spirals and partitioning divergent Dirichlet series at Harvard's Math Table (an undergraduate math colloquium series).

#### Prof. Michael Brenner Group (May 2021–November 2021)

- Wrote a cellular automata model for mutualistic microbial communities in Python (mentor: Alma Dal Co).
- Developed functionality to introduce mutants in the cellular automata and analyze the results.
- Publication: Global dynamics of microbial communities emerge from local interaction rules (2022). van Vliet S, Hauert C, Fridberg K, Ackermann M, Dal Co A. PLOS Computational Biology 18(3): e1009877. <https://doi.org/10.1371/journal.pcbi.1009877>

#### Prof. Mikhail Lukin Lab Group (March 2020–November 2020)

- Developed python program that efficiently optimizes microwave pulse generation for driving SiV spin qubits.
- Interfaced with lab devices to conduct remote optimization tests.

#### Prof. Theodore Betley Lab Group (February 2019–February 2020)

- Synthesized and characterized triiron clusters to examine reactivity with small-molecule substrates.

### UNIVERSITY OF COLORADO BOULDER

#### Prof. Mark Ablowitz Group (June 2022–present)

- Ongoing project: derive and analytically solve a fractional generalization of the discrete Korteweg de Vries and Toda lattice equations.
- After obtaining the correct discrete evolution operator, I am working to prove completeness of the eigenfunctions to obtain a spectral (fractional) representation of the operator.

#### Prof. Michael Marshak Lab Group (June 2016–August 2018)

- Synthesized a novel mixed iron/manganese sulfate compound (Fe/Mn-rhomboclase).
- Delivered oral presentation at the August 2018 American Chemical Society national meeting.

### POLYMATH REU (June 2021-August 2021)

- Working with Prof. Yunus Zeytuncu, I developed a novel, simple formula for the isogonal conjugate point in triangles using Blaschke products.

## Skills

**Technical:** Mathematica, Python, MATLAB, LaTeX, Git, POV-Ray, some familiarity with Java and C++.

**Research:** Asymptotics of sums and integrals, algebraic manipulations, series manipulations, contour integration, stochastic optimization, implementing stochastic cellular automata, implementing a particle-in-cell (PIC) plasma model, numerical integration and differentiation, numerical linear algebra, inorganic synthesis, retrosynthetic analysis.

**Additional:** Creative problem solving, pattern recognition, presenting results orally and in writing (with good clarity of exposition).

### **Honors and Awards**

- Regeneron Science Talent Search—6<sup>th</sup> Place (2018)
- Intel International Science and Engineering Fair—1<sup>st</sup> and Best in Chemistry Category (2017)
- Colorado Science and Engineering Fair—1<sup>st</sup> Place in Environmental Sciences (2016)
- USA Climbing Youth National Championships—placed top 30 (2013-2016)