

# Aidan Winblad

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Fort Collins, Colorado | DoB: 02/24/1992 | Citizenship: U.S.A.

March 3, 2025

## Professional Summary

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Ph.D. candidate in physics specializing in condensed matter, set to graduate in May 2025, with over 10 years of experience in computational modeling and numerical analysis. Research focused on topological phenomena in low-dimensional systems, including topological superconductors and topological insulators. Skilled in applying analytical and numerical methods to solve partial differential equations, analyze eigenmodes, determine topological states, and present findings intuitively. Proficient in Python (NumPy, SciPy, Matplotlib) and Mathematica scripting. Published in peer-reviewed journals and presented at several physics conferences. Eager to apply analytical and numerical techniques for simulating and visualizing physics.

## Work Experience

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**Graduate Research and Teaching Assistant**, Colorado State University Physics Department – Fort Collins, Colorado Aug 2016 – May 2025

- Applied analytical and numerical techniques to show superconducting triangular islands can host and braid Majorana fermions with a rotating gauge potential. Demonstrated braiding of a 4-qubit system on a minimal network of triangular islands. Contributing to novel approaches in topological quantum computing outside of 1D wire junctions.
- Through analytical and perturbation techniques, showed oblique incident circularly polarized light on Dirac and 2D electron gas systems induces quantum Hall effect. Laser light electric field is shown to cause an effective magnetic field experienced by the materials. An important push in the study of nonequilibrium physics.
- Both projects involved constructing large matrices and a nearest neighbor algorithm. Collaborated within the research group to optimize nearest neighbor algorithms, reducing computation times and improved efficiency of Hamiltonian matrix construction.
- Organized and facilitated journals clubs and conference events alongside my advisor.
- As a teacher assistant: taught labs and recitations, tutored students, graded coursework and exams, and proctored exams. Versed in patience and can adapt teaching style to cater to different student needs.

**Computational Physicist, Contractor**, Engility – Fort Sam Houston AFRL, Texas June 2015 – Aug 2016

- Developed and tested ray tracing physics to simulate laser tissue interactions.
- Developed a hot spot and temperature gradient tracker from thermal radiation video data.
- Examined damage prediction models, performed experimental validation, and set safety standards.
- Authored technical reports, proceedings papers, and journal articles and presented on research results.

## Education

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**Ph.D. in Physics**, Colorado State University, Fort Collins, Colorado May 2025

**M.S. in Physics**, Colorado State University, Fort Collins, Colorado Dec 2019

**B.S. in Mathematics and B.S. in Physics**, Fort Hays State University, Hays, Kansas May 2015

## Publications

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- Brett H. Hokr, Aidan Winblad, Joel N. Bixler, Gabriel Elpers, Byron Zollars, Marlan O. Scully, Vladislav V. Yakovlev, and Robert J. Thomas. Accurately modeling Gaussian beam propagation in the context of Monte Carlo techniques. In *Optical Interactions with Tissue and Cells XXVII*, volume 9706, pages 179–185. SPIE, March 2016
- Aidan Winblad and Hua Chen. Superconducting triangular islands as a platform for manipulating Majorana zero modes. *Phys. Rev. B*, 109(20):205158, May 2024
- Aidan Winblad, Muhammad Tahir, and Hua Chen. Landau level-like topological Floquet Hamiltonians. *to be submitted*, 2025

## Technologies

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**Current proficiencies:** Python3 (NumPy, SciPy, and Matplotlib), Git, i3-wm,  $\text{\LaTeX}$ , Vim

**Exposure to:** Bash/Shell, C/C++, FORTRAN 90, Gnuplot, Linux/Unix, Mathematica, Obsidian (markdown), Python2, Zotero

**Limited exposure to:** ALE3D, Arduino, Blender, MATLAB, Objective-C, Rust, Swift, Typescript

## Computational Physics Experience

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- Graph Theory
  - Developed a shortest path algorithm for optimizing foot traffic on campus sidewalks. (C++)
- Classical Mechanics and Chaos
  - Solved ODE of damped-driven pendulum to show chaotic motion with RK4. (C++)
- Electromagnetic Modeling
  - Simulated potential and electric field of conductors using SOR. (C++)
  - Simulated propagation of electromagnetic wave in 1D using FDTD. (C++)
  - Developed a 2D (r,z) Focused Gaussian Beam Monte-Carlo Multi-Layer method, with ABCD transforms, for modeling energy deposits into tissue for laser tissue interactions. (C++)
- Heat Transfer
  - Solved Heat equation for a 2D system using SOR. (C++)
- Quantum Simulations
  - Simulated a Gaussian Wave packet in 1D Schrodinger equation infinite square well using Goldberg method and 2D infinite square well using ADI method. (FORTRAN 90)
  - Computed eigenvalues and states of Schrodinger equation for 1D harmonic oscillator using FEM. (Python2)
- Topological Materials
  - Developed numerical methods for modeling topological quantum computing logic gates of superconducting triangular islands, advancing research on new platforms for quantum computation. (Python3)
  - Modeled quantum Hall effect in nonequilibrium system using Floquet theory of oblique incident circularly polarized light upon Dirac or 2DEG substrates. (Python3)