Aidan Winblad

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Professional Summary

I am a recent physics Ph.D. graduate who specialized in condensed matter physics and with 10+ years of experience in computational modeling and numerical analysis. My research topics focused on topological phenomena in low dimensional systems, such as topological superconductors and topological insulators. Research skills include analytical and numerical methods to solve partial differential, examine eigenmodes, determine topological states, and presenting findings intuitively. Most of my Ph.D. research used Python3 (numpy, scipy, and matplotlib) and some Mathematica scripting. I am published in peer-reviewed journals and have presented at several physics conferences. Eager to apply analytical and numerical techniques to simulate and visualize physics.

Work Experience

Graduate Research and Teacher Assistant, Colorado State University Physics Department – Fort Collins, CO — Aug 2016 – May 2025

- As a teaching assistant, I taught labs and recitations, tutored students, graded coursework and exams, and proctored exams. I am versed in patience and can adapt my teaching communication to cater to different learning needs.
- Using analytical and numerical analysis I showed 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, I 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 non-equilibrium physics.
- Both projects involved building large matrices and using a nearest neighbor algorithm. Collaborated within my research group to optimize nearest neighbor algorithms, reducing computation times and improved efficiency of Hamiltonian matrix construction.

Computational Physicist, Contractor, Engility – Fort Sam Houston AFRL, TX — June 2015 – Aug 2016

- Developing and testing ray tracing physics to simulate laser tissue interactions.
- Developing a hot spot and temperature gradient tracker from thermal radiation video data.
- Examine damage prediction models, perform experimental validation, and set safety standards.
- Writing technical reports, presenting results in presentations, proceedings, and journal articles.

Education

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

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

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

Publications

- 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. *tbd:Arxiv*, 2025

Technologies

Current proficiencies: Python3 (numpy and matplotlib), Git, i3-wm, 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

- 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 non-equilibrium system using Floquet theory of oblique incident circularly polarized light upon Dirac or 2DEG substrates. (Python3)