William S. Parker

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EDUCATION

University of Oregon, Eugene, OR — Fall 2024
Doctor of Philosophy, Physics
PhD Advisor: Benjamin J. McMorran
GPA: 3.880

Chapman University, Orange, California — Spring 2018
Bachelor of Science, Physics — Bachelor of Science, Mathematics — Minor: General Music
GPA: 3.729 (*Magna Cum Laude)*

RESEARCH

PhD Candidate, University of Oregon, Eugene, OR — Mar. 2020 – Dec. 2024
Advisor: Benjamin J. McMorran

Determined and modeled the 3D structure of hybrid skyrmions in magnetic multilayer thin films.

- Experimentally determined the 3D structure of hybrid magnetic skyrmions by combining complementary electron microscopy techniques to isolate surface and bulk behavior.
- Conceived of and formalized a novel 3D topological object, the half-integer hopfion, to link the exceptional stability of hybrid skyrmions to their underlying topology.
- Derived quantitative measurables from the half-integer hopfion formalism to validate experimental results against theoretical predictions.
- Designed and performed micromagnetic simulations to bridge experiment and theory.
- Developed novel holographic magnetic imaging techniques at the National Center for Electron Microscopy with the potential for atomic-resolution, depth-resolved magnetic microscopy.
- Presented work to the scientific community in talks at multiple international microscopy and magnetics conferences.

Graduate Research Assistant, University of Oregon, Eugene, OR — June 2018 – Mar. 2020
Advisor: Benjamin J. McMorran

Investigated practical considerations of an orbital angular momentum sorter in a commercial TEM.

- Modeled electrostatic electron-optical elements with finite element methods and Fourier optics.
- Fabricated informed prototypes using atom probe tomography sample preparation techniques in a dual-beam FIB/SEM system.
- Presented feasibility considerations to a wide audience at the international Microscopy and Microanalysis conference, earning the MSA Student Scholar award.

Undergraduate Researcher, Chapman University, Orange, CA — Spring 2017 – Spring 2018
Advisor: Jerry LaRue

Created vortex optical states for Raman spectroscopy applications using a digital micromirror device.

- Wrote custom software to generate custom optical modes with binary diffractive holograms.
- Designed and built a Mach-Zehnder interferometer to characterize the generated optical states.

Undergraduate Researcher (NSF REU), University of Rochester, Rochester, NY — Summer 2017
Advisor: Joseph Eberly

Investigated fundamental limitations to mode-locked lasers, focusing on phase noise, lasing cavity length, and novel frequency distributions.

RELEVANT EXPERTISE

Experimental Techniques: (S)TEM, Lorentz TEM, dual-beam FIB/SEM, ultra-high vacuum systems
Quantitative Skills: numerical simulation, Fourier optics, electron optics, (2D) signal/image analysis
Programming Languages: Python, LaTeX, JS/HTML/CSS
Programming Experience: Lorentz TEM phase reconstruction, micromagnetic simulation (MuMax3), image and signal processing (OpenCV, FIJI), high-performance computing, SSH, *nix command line, 3D graphics (Blender)

Scientific package & web development with Git version control:

`ltempy` – tools for the analysis, simulation, and presentation of LTEM data
`ovf2io` – I/O package for the OOMMF Vector Field format
`frctl` | `(GitHub)` – an interactive fractal explorer built in Svelte

HONORS & SCHOLARSHIPS

Best Student Presentation - Finalist Oct. 2023
Magnetism and Magnetic Materials
Honorable Mention Apr. 2020
NSF Graduate Research Fellowship Program
Student Scholar Award Aug. 2019
Microscopy and Microanalysis
Graduate First Year Fellowship Fall 2018 - Spring 2019
University of Oregon
OMQ Director's Fellowship Fall 2018
University of Oregon
Outstanding Senior in Physics Spring 2018
Chapman University
Chancellor's Scholarship Fall 2014 - Spring 2018
Chapman University
Chapman Celebrates - Music Fall 2014 - Spring 2018
Chapman University
Golden Ears Award May 2016
Chapman University

PUBLICATIONS

Published Manuscripts

1. **Parker, W. S.**; Reddinger, J.; McMorran, B. J. Hybrid Skyrmions in Magnetic Multilayer Thin Films are Half-Integer Hopfions. *Phys. Rev. B.* **2024.** DOI: 10.1103/PhysRevB.110.224420
2. **Parker, W. S.**; Montoya, S. A.; Fullerton, E. E.; McMorran, B. J. Combining Lorentz TEM and SEM with Polarization Analysis to Uncover Fractional Topological Spin Textures in Fe/Gd Multilayer Thin Films. *Microscopy and Microanalysis* **2024**, *30* (Supplement_1), ozae044.507. DOI.
3. Ducharme, A.; **Parker, W.**; Yasin, F. S.; Yu, X.; McMorran, B. Lorentz Scanning Transmission Electron Microscopy Holography (LSTEMH) Measurement of Domain Walls in Fe/Gd Multilayers. *Microscopy and Microanalysis* **2024**, *30* (Supplement_1), ozae044.510. DOI.

4. **Parker, W. S.**; Montoya, S. A.; Fullerton, E. E.; McMorran, B. Evolution of Novel Chiral Spin Textures in Fe/Gd Based Multilayer Thin Films. *Microscopy and Microanalysis* **2022**, *28* (S1), 2336–2337. DOI.
5. Reddinger, J.; **Parker, W.** Micromagnetics Simulation as a Supplement to and Diagnostic for Lorentz Transmission Electron Microscopy. *Microscopy and Microanalysis* **2022**, *28* (S1), 1694–1696. DOI.
6. **Parker, W.**; Montoya, S.; Fullerton, E.; McMorran, B. Chiral Spin Textures in Fe/Gd Based Multilayer Thin Films. *Microsc Microanal* **2021**, *27* (S1), 2404–2407. DOI.
7. Johnson, C. W.; Pierce, J. S.; Moraski, R. C.; Turner, A. E.; Greenberg, A. T.; **Parker, W. S.**; McMorran, B. J. Exact Design of Complex Amplitude Holograms for Producing Arbitrary Scalar Fields. *Opt. Express* **2020**, *28* (12), 17334. DOI.
8. **Parker, W.**; McMorran, B. Feasibility of an Electron Orbital Angular Momentum Sorter. *Microsc Microanal* **2019**, *25* (S2), 90–91. DOI.

Manuscripts in Preparation

1. **Parker, W. S.**; Reddinger, J.; Montoya, S. A.; Fullerton, E. E.; McMorran, B. J. Real Space Imaging of Hybrid Skyrmion Textures in Magnetic Multilayer Thin Films. *In preparation.* **2024.**
2. **Parker, W. S.**; Ducharme, A.; Yasin, F. S.; Montoya, S. A.; Yu, X.; Fullerton, E. E.; McMorran, B. J. STEM Holographic Imaging of Magnetic Domains in Fe/Gd Multilayer Thin Films. *In preparation.* **2024.**

CONFERENCES & WORKSHOPS

Poster Presenter July 2024
Microscopy and Microanalysis, Cleveland, Ohio
Combining Lorentz TEM and SEM with Polarization Analysis to Uncover Fractional Topological Spin Textures in Fe/Gd Multilayer Thin Films

Oral Presenter - Featured Student Award Finalist Oct. 2023
Magnetism and Magnetic Materials, Dallas, Texas
Skyrmions in Magnetic Multilayer Thin Films Are Half-Integer Hopfions

Poster Presenter Sep. 2023
OMQ Fall Research Symposium, Eugene, Oregon
STEM Holographic Imaging of Magnetic Domains in Fe/Gd Magnetic Thin Films

Oral Presenter Aug. 2022
Microscopy and Microanalysis, Portland, Oregon
Evolution of novel chiral spin textures in Fe/Gd based multilayer thin films

Oral Presenter Jan. 2022
Magnetism and Magnetic Materials – Intermag, Attended Virtual
Evolution of novel chiral spin textures in Fe/Gd multilayer thin films

Poster Presenter Aug. 2021
Microscopy and Microanalysis, Attended virtual
Chiral spin textures in non-trivial geometries in FeGd multilayer thin films

Poster Presenter Aug. 2019
Microscopy and Microanalysis, Portland, Oregon
Feasibility of an Electron Orbital Angular Momentum Sorter

Poster Presenter Sep. 2018
OMQ Fall Research Symposium, Eugene, Oregon
Characterization of an Orbital Angular Momentum Sorter

STUDENT MENTORING

Kay Brown, MASTERIt summer undergraduate — Summer 2024
Talia Ruehr, MASTERIt summer undergraduate — Summer 2024
Aaron Casserly, UO Undergraduate. — Fall 2022 - Fall 2023
Grant Osmon, REU student — Summer 2022
Paige Richey, REU student — Summer 2022
Samuel Pabst, ESPRIT scholar — Summer 2021
Bart Rosenzweig, REU student. — Summer 2019

OUTREACH ENGAGEMENT

Coordinator and Student Assistant, University of Oregon, Eugene, OR — Spring 2021
Mad Duck Science Fridays,
Led middle school students through a variety of STEM activities on days when school was cancelled due to budget restraints.

Undergraduate Panelist, Chapman University, Orange, CA — Fall 2017
Discover Chapman Day
Acted as a panelist to answer questions about being a STEM undergraduate at Chapman university from prospective students.

Guitarist, Chapman University, Orange, CA — Fall 2017
Discover Chapman Day
Played guitar in Chapman's Tesla Coil band for a combined audience of prospective students and middle school students.

Onsite Activity Lead, Chapman University, Orange, CA — Fall 2017
Egg drop competition, Cypress High School
Helped high school students design and test egg drop apparatus.

Material Preparations, Chapman University, Orange, CA — Fall 2017
Physics Bootcamp
Prepared materials to help incoming physics students learn the mathematics required for physics courses to help boost student retention in physics.

TEACHING EXPERIENCE

Graduate Teaching Assistant — University of Oregon
PHYS 152 (Physics of Sound & Music) — Fall 2022
Teaching Assistant for undergraduate students, primarily non-STEM.
PHYS 201 (General Physics) — Fall 2019
Teaching Assistant for undergraduate students. Led lab sections.

Supplemental Instructor — Chapman University
PHYS 102 (General Physics 2) — Fall 2017
Led additional weekly instruction sessions for undergraduate students.
PHYS 101 (General Physics 1) — Spring 2017
Led additional weekly instruction sessions for undergraduate students.