DUSTON WETZEL
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Research Interests

Nanoscale Physics, Nanotechnology, Spintronics, Magnetoresistance (MR), Thin Films and Heterostructures, Magnetism, Novel Quantum Materials, Metamaterials, Helical Weaves, Wire-woven Cellular Metals, Textiles

Education

Ph.D. Applied Physics | December 2024 | Southern Illinois University | Carbondale, IL
- Advisor: Prof. Dipanjan Mazumdar
- Dissertation title: MAGNETOTRANSPORT PROPERTIES OF POLYCRYSTALLINE $Mn_{3-x}Fe_xSn$ (x = 1, 2) THIN FILMS
- GPA: 3.8/4.0

M.S. Physics | May 2021 | Southern Illinois University | Carbondale, IL
- Advisor: Prof. Dipanjan Mazumdar
- Thesis title: "ROOM TEMPERATURE MAGNETORESISTANCE IN LARGE AREA Co/Bi_2Se_3 BILAYERS"
- GPA: 3.8/4.0

B.S. Nanoscience: Nanoscale Physics | April 2017 | Northwest Missouri State University | Maryville, MO
- GPA: 3.6/4.0
- Honors Program Graduate

Professional Experience

Research Scientist | September 2024 – December 2024 | SIU Department of Physics and Applied Physics| Carbondale, IL
- Assembled and automated magneto-optics experiments in Quantum Optics/Quantum Materials Laboratory (PI: Dr. Bumsu Lee)

Research Assistant | April 2021 – August 2024 | SIU Department of Physics and Applied Physics, Carbondale, IL
- Experimentally studied magnetotransport in the Novel Materials and Heterostructures Laboratory (member since Fall 2018)

Teaching Assistant | January 2018 – April 2021 | SIU Department of Physics and Applied Physics | Carbondale, IL
- Taught 100 and 200 level physics introduction, mechanics, and electromagnetism laboratory courses

GIS Digitizer | December 2013 – August 2017 | Midland GIS Solutions, Maryville MO
- Digitized tax map dimensions and water, forest, and soil-type boundaries

Technology Support Assistant | August 2013 – December 2015 | NWMSU, Maryville, MO
- Repaired student issued laptop hardware and gave technical assistance in university library

Aquatics Director/Staff Member | Summers 2013-2016 | Camp Geiger, St. Joseph, MO
- 4 summers teaching swimming, boating, lifeguarding; 2 summers managing pool staff (8-10 people) and maintaining pool

Research Experience

Magnetotransport
- Designed, built, and automated three magnetotransport experimental setups (in-plane, out-of-plane, rotational)
- 6 years of experience making 4-probe measurements with micropositioners (in-line, Van der Pauw, Hall bars)
- Experience with Physical Properties Measurement Systems and wire bonding

Instrument Implementation and Automation
- 6 years of experience developing LabVIEW VIs (Keithley, KEPCO, DATAQ, Thorlabs Kinesis)

Thin Film Device Optimization
- Designed hall bar and contact pad sputtering stencils with AutoCAD
- Designed and built magnetic annealing station
- Experience with X-ray Reflection and X-ray Diffraction

Magnetron Sputtering
- Understanding of theory and experience with film deposition
- Experience maintaining and upgrading vacuum chambers
  (cleaning, target replacement, in situ residual gas analyzer implementation, vacuum pump upgrades)

Magneto-optics
- Assisted in design and implementation of Magneto-Optical Kerr Effect microcsopy experimental setup

Experiment Development
- Over 6 years experience prototyping and troubleshooting new experiments.
- Experience machining custom aluminum pieces for optical table

Data Analysis
- Experience analyzing and displaying data with LaTeX, Excel, Origin, Mathematica, Fortran, Python

Electromagnetism Theory
- Contributed to calculation of magnetostatic interaction energy between point magnet and ring magnet.
- Experience solving analytical and numerical problems related to the Casimir Effect

Magnetotransport Effects Experimentally Studied
- Hall Effect, Planar Hall Effect, Anomolous Hall Effect, Topological Hall Effect in Mn_2FeSn
- Ordinary MR, Anisotropic MR (longitudinal, transverse, angular), Giant MR, Novel unidirectional MR in Co/Bi_2Se_3
- Magnetic Phase Transitions (including possibility of spin-glass phase) in Mn_2FeSn thin films

Publications and Manuscripts

- Growth and magnetic properties of $Mn_{3-x}Fe_xSn$ thin films for spintronics applications (x = 0, 1, and 2). Yub Raj Sapkota, J.L. Sanchez Llamazares, Stephen Hofer, Duston Wetzel, Dipanjan Mazumdar (manuscript under preparation)
- "Effect of substrate on polycrystalline hexagonal Fe_2MnSn thin films grown by magnetron sputtering". Duston Wetzel, Stephen Hofer, Kenneth Stiwinter, and Dipanjan Mazumdar (manuscript under preparation)
- "Magnetic, magnetotransport, and anomalous Hall effect behavior in polycrystalline hexagonal Mn_2FeSn thin films". Duston Wetzel, J.L. Sanchez Llamazares, Jesse Balgley, Erik Henriksen, and Dipanjan Mazumdar (manuscript under preparation)
- "MAGNETOTRANSPORT PROPERTIES OF POLYCRYSTALLINE $Mn_{3-x}Fe_xSn$ (x = 1, 2) THIN FILMS". Duston Wetzel (dissertation approved but not yet published)
- "Triply Periodic Helical Weaves". Duston Wetzel, Paul Gailiunas, Moses Gaither-Ganim, and William Holt. Proceedings of Bridges 2024: Mathematics, Art, Music, Architecture, Culture pg 267-274 (2024) https://archive.bridgesmathart.org/2024/bridges2024-267.pdf
- " Magnetostatic interaction energy between a point magnet and a ring magnet". Niranjan Warnakulasooriya, Dinuka H. Gallaba, John Joseph Marchetta, Duston Wetzel, Prachi Parashar, and K.V. Shajesh. Physics Open, 15, 100140 (2023) https://www.sciencedirect.com/science/article/pii/S2666032623000054
  "ROOM TEMPERATURE MAGNETORESISTANCE IN LARGE AREA Co/Bi2Se3 BILAYERS". Duston Wetzel OpenSIUC (2021) https://opensiuc.lib.siu.edu/theses/2841/

Presentations

American Physical Society March Meeting

- "Magnetic, Magnetotransport, and Anomalous Hall Effect Behavior in Polycrystalline Hexagonal Mn_2FeSn Thin Films" | 2024 (oral)
- "Effect of substrate on polycrystalline hexagonal Fe_2MnSn films grown by magnetron sputtering method" | 2024 (poster)
- "Magnetotransport properties of polycrystalline Fe_2MnSn thin films | 2022 (poster)
- "Large Unidirectional Magnetoresistance in Topological Insulator/Ferromagnet Bilayers" | 2020 (poster)

Southern Illinois University - Carbondale

- "Triply Periodic Helical Weaves" | Alan Schoen Inagaural Memorial Lecture | September 2024
  Discussed 22 TPHWs including 10 physical models https://echo360.org/public/media/d72e1bd8-cdde-4a16-b344-b0ba4e710404
- "MAGNETOTRANSPORT PROPERTIES OF POLYCRYSTALLINE $Mn_{3-x}Fe_xSn$ (x = 1, 2) THIN FILMS" | May 2024
  Successfully defended doctoral dissertation
- "Triply Periodic and Polyhedral Helical Weaves" | Mathematics – Fall 2023
  Presented 25 physical and/or simulated helical weaves: 2D, triply periodic, and polyhedral (featured collaborators' work)
  https://echo360.org/public/media/b55fed07-add6-4b7d-b1c8-ddf20f52fa97
- "From Gyroid to the Triply Periodic Helix Linkages" | Mathematics – Spring 2023
  Presented 5 3D arrangements of woven helices https://echo360.org/public/media/2e33ccac-8756-409c-abb5-0c2faa097955
- "ROOM TEMPERATURE MAGNETORESISTANCE IN LARGE AREA Co/Bi_2Se_3 BILAYERS" | Physics - May 2021
  Successfully defended master's thesis
- "How to build a Gyroid: Exploring the Minimal Surface and its Lattice" | Physics - Fall 2019, Mathematics - Spring 2020
  Presented discovery of novel stable triply periodic arrangement of woven helices related to the gyroid minimal surface
- "The Premelting of Ice due to Dispersion Forces" | SIU Physics - Fall 2018
  Presented numerical (Fortran) calculation of the thickness of a liquid water layer formed on nanoscopic ice sphere due to differences in dielectric properties of ice and water
- Lead several physics demonstrations for visiting students from SIU, Rend Lake College, John A. Logan College | 2019-2023
  Built and demonstrated stability in inverted pendulem; Demonstrated Meissner effect, electroscope, conservation of AM

Other Scholastic Activitites and Interests

- Helical weaves portfolio at https://www.instagram.com/wetzelsweaves
- Presented paper and displayed 10 sculptures at Bridges international mathematics/art conference in Richmond, VA | August 2024
  https://gallery.bridgesmathart.org/exhibitions/bridges-2024-exhibition-of-mathematical-art/duston-wetzel
- Featured in Wolfram Staff Picks "Triply Periodic Helical Weaves" https://community.wolfram.com/groups/-/m/t/3126212 | 2024
- Displayed "Minimallly Entwined" scuplture and attended Bridges international mathematics/art conference in Halifax | August 2023
  https://gallery.bridgesmathart.org/exhibitions/2023-bridges-conference/duston-wetzel
- Participated in weekly theory meetings investigating stability in magnetic levitation | Summer 2021 – Spring 2023
- Assisted in assembly of "Yellow Moon Gyroid" art installation in SIU Morris Library | February 2023
- Attended workshop at Norwegian University of Science and Technology in Trondheim, Norway | June 2018
  Assisted in investigation of the role of zero point energy in promoting ice formation in a spherical drop of water
  https://doi.org/10.1103/PhysRevResearch.1.033210 – advised by Dr. K.V. Shajesh, Physics

Honors and Awards

- SIU Dissertation Research Assistantship Award | 2023
- NWMSU Honors Program Graduate | 2017
- NWMSU Distinguished Scholar Scholarship | 2013 – 2017
- Missouri Bright Flight Scholarship | 2013 – 2017
- Camp Geiger (Boy Scouts) Staff Member of the Year | 2015
- Nodaway-Holt High School Valedictorian | 2013
- Eagle Scout | 2010