

# Alexandria (Xan) McPherson

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## Education

- 9/22 – 12/25 **PhD, Applied Physics**, University of Washington.  
Improving the Methodology and Instrumentation for On-Scalp MEG
- 9/22 – 12/24 **M.S, Applied Physics**, University of Washington.
- 8/17 – 5/21 **B.S., Engineering Physics**, Colorado School of Mines.  
**Minor** Computational and Applied Mathematics

## Research and Teaching Positions

- 2026-Present **Postdoctoral Researcher**, *Gwilliams Laboratory of Speech Neuroscience, Stanford.*
- *Advisor:* Dr. Laura Gwilliams
  - Installation and research using FieldLine OPM-MEG sensor system to further the understanding of speech comprehension on a neuronal level.
- 2022-2025 **Doctoral Researcher**, *Institute for Learning and Brain Sciences, UW.*
- *Advisor:* Dr. Samu Taulu
  - Improving the signal source space model for the next generation of on-scalp magnetoencephalography (MEG) instrumentation, including OPM systems, using the theory of electromagnetism and computational methods including signal space separation, Maxwell Filtering, and MNE-Python.
  - Created, implemented, and tested the novel multi-origin signal space separation method for on-scalp MEG as detailed in the published manuscript in *Physics in Medicine and Biology*
  - Spearhead the research group effort to implement and investigate methods to conduct MEG testing with the on-scalp Kernel Flux OPM system including software optimization, hardware implementation, optimizing the magnetically shielded room for OPM sensors, construction of a compensation coil system, assisting with engineering, and delegating tasks among fellow graduate and undergraduate students.
  - Develop novel mathematical methods for noise optimization of basic component extraction for on-scalp MEG data processing techniques including signal space separation using Foster's inverse, a matrix inversion application of the Wiener-Kolmogorov smoothing theory, while working with and managing undergraduate student researchers as part of a team
  - Skills: MEG, OPMs, electromagnetism, computational linear algebra, academic writing and publishing, collaboration, self-motivation, simulation using Python and MatLab
- 2022-2025 **Teaching Assistant**, *Department of Physics, UW.*
- Teaching undergraduate physics courses in both lab and tutorial settings, responsible for assisting students, facilitating group work, grading, and creating exam questions, solutions, and rubrics. Topics include electromagnetism, waves and optics, classical kinematics, lab safety, and research skill building. Courses taught: PHYS121 Introductory Classical Mechanics (Winter 2023); PHYS122 Introductory Electromagnetism (Fall 2022, Fall 2023, Spring 2025); PHYS123 Introductory Waves and Optics (Spring 2023); PHYS321 Electrostatics (Spring 2024, Fall 2024), PHYS322 Electromagnetism II (Winter 2025), PHYS329 Mathematical Methods of Classical Mechanics (Spring 2025).
  - Skills: teaching, clear communication, student interactions, teamwork, rubric creation, grading
- 2019-2021 **PV Reliability Research Assistant**, *National Renewable Energy Laboratory.*
- Responsible for multiple projects simultaneously furthering the development of testing procedures and evaluation of solar cell material reliability and longevity.

- Laid modeling groundwork for paper "Excess carrier concentration in silicon devices and wafers" investigating how material properties are expected to accelerate light and elevated temperature degradation in solar cells and wafers. Confirm that model results are compatible with device physics equations
- Skills: client interactions, sample construction, vacuum chamber operation, image analysis, data analysis, spectrophotometry, photoluminescence, macro digital photography, infrared photography, simulation development, sample tracking, reporting

2020-2021 **Senior Design Research**, *Fractals, Complexity Science, and the Visual Arts*, CSM.

- Bridged gap between science and humanities by contributing new visual analysis using complex network theories, entropy, and statistical physics to quantify emotional information content in classical paintings.
- Skills: fractional dimension and entropy calculations, group theory, complex network features and creation, Python

## Publications

- **McPherson** et al. *Refined signal space separation methods for on-scalp MEG systems*. Physics in Medicine and Biology, 2025. <https://iopscience.iop.org/article/10.1088/1361-6560/ade6ba>
- Repins, I.L., Jordan, D.C., Woodhouse, M., Theristis, M., Stein, J.S., Seigneur, H.P., Colvin, D.J., Karas, J.F., **McPherson, A.N.**, and Deline, C.. *Long-term impact of light- and elevated temperature-induced degradation on photovoltaic arrays*. MRS Bulletin, Volume 48, 589-601 (March 2023). <https://doi.org/10.1557/s43577-022-00438-8>
- **McPherson, A.N.**, Karas, J.F., Young, D.L. et al. *Excess carrier concentration in silicon devices and wafers: How bulk properties are expected to accelerate light and elevated temperature degradation*. MRS Advances 7, 438–443 (Feb 2022). <https://doi.org/10.1557/s43580-022-00222-5>

## Presentations

- **McPherson, A.N.**, *Refined signal space separation methods for on-scalp MEG systems*. University of Washington Biological Physics Seminars. (May 2025)
- **McPherson, A.N.**, Fahmy, I., Larson, E., Taulu, S., *Optimizing the Signal Space Separation (SSS) method for on-scalp MEG systems*. BioMag, Sydney, Australia (Aug 2024).
- **McPherson, A.N.**, *Excess Carrier Concentration in Silicon Device and Wafers*. Fall Materials Research Society Meeting, Remote (Dec 2021).
- **McPherson, A.N.**, Downie, K., Carr, L.. *Fractals, Complexity Science, and the Visual Arts*. APS March Meeting, Remote (March 2021).

## Training and Courses

Sept 2023 **Cognitive Neuroimaging Skills Training**, MRC Cognition and Brain Sciences Unit, Cambridge.

- Two week training in state-of-the-art methods for open neuroimaging analysis and related methods including theoretical backgrounds and analysis pipeline demonstrations with and hands-on practice. Topics include imaging techniques (fMRI, sMRI, diffusion MRI, tractography, MEG, EEG), brain network analysis and connectivity (Networkx, MVPA, RSA), and brain stimulation (plethysmography, electromyography.)
- Skills: NiPype, fMRIPrep, MNE-Python, BIDS formatting, interpreting data, statistical analysis

Spring 2020 **Nuclear and Solid State Physics: Advanced Physics Lab II**.

- Laboratory investigation topics included gamma radiation, Compton scattering, photoelectric effect, decay and half-life properties, and coincidence spectrometry.
- Skills: Radiation measurement techniques, scintillation detection, radiation safety.

Summer 2019 **Engineering Physics Field Session.**

- Six week course: machine shop telescope construction, optics lab, vacuum science and hardware, digital and analog electronics.
- Skills: oscilloscope use, soldering, TIG welding, thin film deposition technology, mass spectrometry, laser safety, surface characterization techniques, ellipsometer work, LabView, LaTeX, Mathematica

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## Awards and Distinctions

2023 **First Year Excellence Teaching Award**, *Department of Physics, UW.*

- Voted best first year teaching assistant award, nominated by students and faculty

2019 **Society of Women in Physics Fundraising Chair**, *Colorado School of Mines.*

Fall 2018 **Frank Oppenheimer Science and Society Award**, *Colorado School of Mines.*

- Chosen by professor for exemplifying strong writing and synthesizing scientific meaning with human impact

Fall 2019 **Wright Outdoor Innovation Challenge Finalist**, *Colorado School of Mines.*

May 2017 **International Baccalaureate Diploma.**

Fall 2016 **Arts and Education Young Artist's Award.**

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## Volunteering

2024-2025 **Graduate Student Peer Mentor**, *Department of Physics, UW.*

- Volunteer as part of the first year graduate student peer mentor program. Provide support, guidance, and help to the new year of physics graduate students as they navigate academia, research, and teaching. Duties include mentor/mentee lunches, meetings, and event planning.

2019-2020 **Society of Women in Physics Fundraising Chair**, *Department of Physics, CSM.*

- Promote community among students and faculty of marginalized gender within the physics department. Plan and attend monthly meetings addressing topics such as impostor syndrome, grad school applications, self care, and success strategies in STEM.
- Fundraising Chair duties include planning community outreach and events and recruiting members.

2013-2017 **Winter Park National Ski Patrol**, *2016-2017 Vice President.*

- Emergency response on the Resort, maintenance of safe conditions, responsible for group coordination, work as standardized patient to train new and existing members
- Skills: teamwork, medical experience, Outdoor Emergency Care Technician certified, patient care, guest interactions

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## Personal Projects

2013-Present **Professional Watercolor Artist**, [Art By Xan](#).

- Manage my artwork business including private commissions and fundraiser donations. Partnered with the Mines Alumni Foundation to make artwork of the campus.
- Skills: creativity, self-promotion, client interaction