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Seth Peacock

GitHub

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EDUCATION

Ohio State University (OSU) **AU22 – AU24**
Honors Applied Math - Physics Track (BS), Philosophy Minor Cum GPA 3.934/4.0

PREPRINTS

Peacock, S., Vencovsky, V., Whiley, R. E., Mhatre, N., & Bergevin, C. 2025. "Spontaneous Otocoherence Provides a Novel Window Onto the Active Ear." *bioRxiv.* [PRE-PRINT]

Contributions: Improved method to quantify self-coherence of spontaneous otoacoustic emissions (SOAE); engineered dynamic windowing technique addressing time–frequency tradeoff; developed Python package *phaseco*

RESEARCH PROJECTS

Peak-Picking SOAE Spectra with Machine Learning (ML) **October 2024 – Present**
Professor Richard Hughes and Professor Christopher Bergevin OSU and York University
Design and implementation of ML model to identify/characterize SOAE spectral peaks [PAPER DRAFT] [CODE]
Contributions:

- Determined biophysical assumptions needed to solve the ill-posed inverse problem of peak picking
- Adapted existing peak picking approaches from other fields to design peak picking network for our data/needs in SOAE analysis, utilizing both classical and machine learning approaches
- Generated labeled synthetic SOAE data for supervised machine learning

Topological Data Analysis (TDA) of Depressed Mouse Serotonin Concentrations **August 2023 – May 2024**
Professor Janet Best OSU
TDA approach to find differences in serotonin time-series data from depressed vs control mice [CODE]
Contributions:

- Developed novel algorithm for time-series "process" extraction expanding on sublevel set filtration (TDA)
- Discovered CMS mice lost homeostasis after ~30 min, indicating interaction with measurement electrode

RESEARCH PROGRAMS / MENTORING

Fields Undergraduate Summer Research Program (Mentor) **June 2025 – August 2025**
Professor Christopher Bergevin and Professor Natasha Mhatre The Fields Institute
Duties:

- Held regular meetings to facilitate students' introduction to our work in the study of SOAEs
- Proposed research directions tailored to each student's strengths and expressed interests but come together coherently for future publication

Fields Undergraduate Summer Research Program (Participant) **June 2024 – August 2024**
Professor Christopher Bergevin and Professor Natasha Mhatre The Fields Institute
ODE modeling of spontaneous otoacoustic emissions from lizard ears [CODE]
Contributions:

- Wrote and maintained user-friendly modular codebase implementing ODE models of SOAE generation in lizards
- Extended model to incorporate interaural coupling between lizard ears in several ways of varying complexity

Quantifying the Effect of Uncertainty in Basketball (OSU MCM – 1st Place) **November 15th – 17th 2024**
Devised Elo-style ranking to derive a bootstrapped C.I. for the minimum "uncertainty" in a game [PAPER] [CODE]

Eigenvector Phase Retrieval Problem (OSU CYCLE) **January 2023 – May 2023**
Optimized an algorithm with improved efficiency for an eigenvector phase retrieval problem

HONORS AND AWARDS

Ohio State Mathematical Competition in Modeling (MCM) - 1st Place
Ohio State Dean's List (All Semesters)
National Merit Scholar Finalist
Columbus Alternative High School Valedictorian

PRESENTATIONS

Assoc. for Research in Otolaryngology MidWinter Meeting **February 2026**
Otocoherence: Interspecies analysis of phase self-consistency in spontaneous otoacoustic emission

Ohio State Honors Project Symposium **December 2024**
Topological data analysis of depressed mouse serotonin concentrations

Fields Undergraduate Summer Research Program Final Presentations **August 2024**
Modeling and signal processing of spontaneous emissions from lizard ears

Ohio State Cycle Conference **April 2023**
Optimization of an eigenvector phase retrieval problem

SKILLS AND COURSEWORK

Coding

Skills: Digital signal processing, spectral analysis, machine learning, algorithm design, object oriented programming, topological data analysis
Languages: Completed projects in Python, MATLAB, and Java; experience with Julia, Mathematica, JS, C++

OSU Coursework

Applied Math: Computational Neuroscience, Machine Learning, Statistics, Infectious Disease Dynamics
***Math*:** Dynamical Systems, Linear Algebra, ODEs, PDEs, Probability, Real Analysis I & II, Complex Analysis
***Physics*:** Classical Mechanics I & II, Electricity and Magnetism, Relativistic Mechanics, Quantum Mechanics

Self Study

Signal Processing, Topological Data Analysis, Linear Systems Theory, Discrete Mathematics, Circuit Theory

WORK EXPERIENCE

Cyclops Studio and Effects: *Effect Pedal Technician, Studio Engineer, Instructor* **July 2019 – Present**
Duties:

- Design, build, and sell original guitar pedals, repair/resell broken pedals
- Engineer/mix recordings in home studio for various artists
- Teach private music lessons with a focus on music theory and songwriting

Rat Motel: *Band Manager, Songwriter, Performer* **June 2016 – Present**
Duties:

- Book tours through the Midwest and East Coast
- Manage stock of merchandise and web store
- Maintain business records for taxes