Seth Peacock

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GitHub

EDUCATION

The Ohio State University (OSU) **Aug 2022–Dec 2024**
B.S. in Applied Mathematics, Minor in Philosophy (Summa Cum Laude; College Honors) Cum GPA 3.934/4.0

RESEARCH EXPERIENCE

Analyzing self-coherence in oscillations emitted from the ear **Sep 2024–Present**
Supervisors: Prof. Christopher Bergevin; Prof. Natasha Mhatre *Bergevin Lab, York University*
Development of a signal processing method to quantify self-coherence in oscillatory emissions from the ear

- Lead author on bioRxiv preprint (now preparing for *PNAS*); will be presenting at Assoc. for Research in Otolaryngology 2026 MidWinter Meeting
- Developed Python package *phaseco* for our self-coherence method; integrated analyses into a unified codebase
- Engineered dynamic windowing techniques to address an issue related to time–frequency uncertainty

Fields Undergraduate Summer Research Program **Jun 2024–Aug 2024**
Supervisors: Prof. Christopher Bergevin; Prof. Natasha Mhatre *The Fields Institute*
Mathematical modeling of oscillatory emissions from lizard ears during funded research program

- Explored locally coupled oscillator models of these emissions, especially how amplitude-dependent frequency (nonisochronicity) affects synchronization
- Examined how Volterra-series methods can be extended to handle stochastic forcing of nonlinear oscillators
- Expanded existing models to incorporate coupling between lizard ears

Topological data analysis (TDA) of serotonin time-series data **Aug 2023–May 2024**
Supervisor: Prof. Janet Best *OSU*
TDA approach to find differences in serotonin time-series data from depressed vs control mice

- Modified method based on sublevel set filtrations to design algorithm for time-series "process" extraction
- Identified trend suggesting the measurement itself may have disproportionately affected depressed mice

Optimizing an efficient eigenvector phase retrieval algorithm **Jan 2023–May 2023**
Cycle Undergraduate Research with Daniel Packer (PhD Candidate) *OSU*
Designed and implemented methods for efficiently recovering eigenvectors from the absolute value of their entries

PREPRINTS

Peacock, S. N. S., Vencovsky, V., Whiley, R. E., Mhatre, N., & Bergevin, C. (2025). Spontaneous otocoherence of the active ear. https://doi.org/10.1101/2025.11.14.687084 (preparing for submission to *PNAS*)

SELECTED PROJECTS

phaseco
A Python package providing tools for phase autocoherence analysis with dynamic windowing methods

Peak-picking otoacoustic emissions with machine learning
A neural network model to identify features in power spectra of oscillations emitted from the ear

- Designed network by integrating approaches in similar domains; generated synthetic data for supervised learning

Quantifying uncertainty in college basketball
Devised Elo-style ranking to derive a bootstrapped C.I. for the minimum "uncertainty" in a game

- 1st Place at OSU's Mathematical Competition in Modeling, November 15th–17th 2024

PRESENTATIONS

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

OSU Honors Project Symposium **Dec 2024**
Topological data analysis of depressed mouse serotonin concentrations

Fields Undergraduate Summer Research Program Final Presentations **Aug 2024**
Modeling and analyzing spontaneous emissions from lizard ears

HONORS AND AWARDS

Conference travel award for the 2026 Assoc. for Research in Otolaryngology MidWinter Meeting **2025**
1st Place at OSU's Mathematical Competition in Modeling **2024**
OSU Dean's List (all semesters) **2022-2024**
National Merit Scholar Finalist **2018**

TEACHING / MENTORING

Private tutoring in mathematics **Aug 2025–Present**
One-on-one tutoring, primarily in real analysis and proof writing with OSU undergraduates

Mentoring during Fields Undergraduate Summer Research Program **Jun 2025–Aug 2025**
Mentored Prof. Bergevin's group of undergraduates in later iteration of research program

- Proposed accessible entry points based on each student's interests into our research analyzing, modeling, and simulating stochastic oscillations emitted from ears
- Led regular student meetings for troubleshooting and sharing progress

Private music lessons **Jun 2018–Present**
One-on-one lessons in music theory, guitar, bass, and drums

SKILLS AND COURSEWORK

Computational Skills
Topological data analysis, spectral analysis, machine learning
Languages: Python (advanced); MATLAB, Java (intermediate)

OSU Coursework
Applied Mathematics: Quantitative Neuroscience, Machine Learning, Statistics, Infectious Disease Dynamics
Mathematics: 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
Digital signal processing, applied algebraic topology, circuit theory

OTHER EXPERIENCE

Cyclops Studio and Effects: *Effect Pedal Technician, Studio Engineer* **Jul 2019–Present**
Repaired, designed, and built electronic musical effect units; engineered and mixed recordings

Rat Motel: *Band Manager, Songwriter, Performer* **Jun 2016–Present**
Managed tours, merchandise, and financial records, developing project management and organizational skills