DEPARTMENT OF PHYSICS
COLLEGE OF ARTS AND SCIENCE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2025

PROJECT TITLE: from formants to resonances

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Project Description

This project is positioned at the intersection of physics and speech science. The resonance structure of the vocal tract is an important aspect of analyzing vocal patterns in the context of speech, language, and hearing sciences (SLHS). Many audio encoding algorithms, including those used by Zoom, rely upon resonance analysis to determine relevant frequency ranges to reproduce at high fidelity. Current algorithms rely heavily on linear predictive coding (LPC) which suffer from a number of known issues by relying on a simplified underlying model. These issues include introducing a systematic bias into resonance results.

This project is an exploratory investigation of implementing new methods for analyzing formant and resonance structure. Depending on the skill set of the student, a number of goals are possible.

(1) Implement PLC in Audacity.
(2) Work with Praat to understand current formant analysis limitations.
(3) Use machine learning to develop a resonance analysis model.

Students do not need to have previous experience with speech analysis, and suitable mentoring will be provided. Programming skills in either C++ or Python are preferable but not required. A working knowledge of calculus is necessary.