

# Sonification of Squeezed Vacuum State of Light: Unveiling Quantum Dynamics through Sound

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The nature of quantum states of light is inherently governed by the Heisenberg uncertainty principle, leading to the presence of zero-point energy. A squeezed vacuum state emerges as a reshaped fluctuation of this zero-point energy. To characterize and comprehend a squeezed vacuum, the utilization of a bright field becomes pivotal. This bright field not only amplifies the squeezed vacuum but also elevates it above the classical photodetectors' detection threshold. Transforming the detected electrical signals of the squeezed vacuum into sound via speakers provides an additional auditory dimension to grasp the intricacies of this quantum concept.

In this presentation, I will introduce a device designed for generating a squeezed vacuum. A simple and cost-effective headphone has been ingeniously modified to convert electrical signals into sound, enabling us to explore various points in the squeezed vacuum generation system. Throughout the talk, we will experience the steady sound of a squeezed vacuum state. By systematically scanning the phase difference between the squeezed vacuum and the bright field, we can discern the intricate structure of the squeezed vacuum.

This exploration into sonification not only enhances our understanding of quantum dynamics but also demonstrates a practical and accessible approach to studying squeezed vacuum states.

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**Session Classification:** Sonification of data, Citizen Science and Educational aspects of CREDO