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2024 Spring Meeting of the APS Eastern Great Lakes Section Friday–Saturday, April 12–13, 2024; Kettering University, Flint, Michigan

Session Q01: Applied and Computational Physics

9:30 AM–11:00 AM, Saturday, April 13, 2024
Kettering University Room: 4-103 AB

Chair: Zifeng Yang, Wright State University

Abstract: Q01.00001 : Potential of Nonlinear Phi-Bit Modes in Elastic Systems to Revolutionize Quantum-Analogue Computing*

9:30 AM–9:45 AM

[Abstract →](#)

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Phi-bits, akin to the quantum concept of qubits but in a classical mechanical framework, play a critical role in the development of quantum-analogue computing, and hence, understanding the nonlinear dynamics governing their control and interactions is crucial. These phi-bits, represented by acoustic waves within nonlinearly coupled arrays of waveguides, can exist in coherent superpositions of states. Adjusting external drivers' frequency, amplitude, and phase allows precise control over the phi-bit states. We have devised a discrete element model to analyze and predict the nonlinear response of phi-bits to external drivers, considering various types, strengths, and orders of nonlinearity stemming from intrinsic medium coupling among waveguides and external factors like signal generators, transducers, and ultrasonic couplant assemblies. Notable findings include the influence of nonlinearity type, strength, and order on the complex amplitudes within the coherent superposition of phi-bit states. This investigation serves as a groundwork for controlling design parameters in phi-bit creation, facilitating the preparation and manipulation of state superpositions crucial for developing phi-bit-based quantum analogue information processing platforms.

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