Bulletin of the American Physical Society

APS March Meeting 2024
Monday–Friday, March 4–8, 2024; Minneapolis & Virtual

Session LL05: V: General Physics II
4:00 PM–6:00 PM, Wednesday, March 6, 2024
Room: Virtual Room 05

Sponsoring Unit: APS/SPS
Chair: Lin Su, Harvard University; James Espinosa, Weatherford College

Abstract: LL05.00008 : Exploring and Controlling Nonlinear Phi-Bit Modes in Elastic Systems for Quantum-Analogue Computing*

5:24 PM–5:36 PM

← Abstract →

Presenter:
Abrar Nur E Faiaz
(Wayne State University)

Authors:
Abrar Nur E Faiaz
(Wayne State University)

Akinsanmi S Ige
(University of Arizona)

Kazi Tahsin Mahmood
(Wayne State University)

M Arif Hasan
(Wayne State University)

Pierre Deymier
(University of Arizona)

Keith Runge
(University of Arizona)

Josh Levine
(University of Arizona)

Phi-bits are classical mechanical analogues of qubits. Comprehending the nonlinear phenomena that underlie the control and relationships between phi-bits is of utmost importance for advancing phi-bit-based quantum-analogue computing systems. Phi-bits are acoustic waves in externally driven nonlinearly coupled arrays of waveguides, that can exist in a coherent superposition of two states. Tuning the frequency, amplitude, and phase of external drivers is a means of controlling the phi-bit states. We have developed a discrete element model to analyze and predict the nonlinear phi-bit response to external drivers that may result from different types, strengths, and orders of nonlinearity due to the presence of (i) intrinsic medium (epoxy) coupling the waveguides and (ii) external factors such as signal generators/transducers/ultrasonic couplant assembly. Key findings include the impact of nonlinearity type, strength, and order as well as damping on the modulus and phases of the complex amplitudes of the phi-bit coherent superposition of states. This research serves as an exploration for control of design parameters in the creation of phi-bits, which will enable the preparation and manipulation of superpositions of states essential for developing phi-bit-based quantum analogue information processing platforms.

* NSF grant # 2204382, 2204400, 2242925