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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: Q01.00002 : Quantum Concepts in Classical Realms: Berry Phases and Elastic Bits in Granular Systems*
9:45 AM–10:00 AM

← *Abstract* →

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The Berry phase, a concept of significant interest in quantum and classical mechanics, illuminates the dynamics of physical systems. Our current study explores this phenomenon within a classical granular network, employing an "elastic bit" that serves as a classical counterpart to the quantum bit. This approach establishes a connection between classical and quantum mechanics. By adjusting external forces, we generate an elastic bit within the granular network and map its behavior onto a Bloch sphere, akin to operating quantum logic gates. Varied manipulations of these external drivers yield a spectrum of Berry phases, from trivial (0) to nontrivial (π), unveiling the topological nature of the elastic bit. Crucially, this topological behavior is governed by external manipulations rather than the material or geometric properties of the medium. The nontrivial Berry phases, in particular, highlight energy localization within the granule vibrations, marking a significant insight into system dynamics. This research bridges the gap between the quantum and classical realms and paves the way for designing novel materials with unique properties.

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