2025 MRS Spring Meeting & Exhibit

CH03.04.03

Band Engineering and Microscopy in LiNbO3 Acoustic Metamaterials

When and Where

Apr 9, 2025
9:15am - 9:45am

Summit, Level 3, Room 345

Presenter(s)

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Abstract

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We report direct, frequency-dependent imaging of surface acoustic waves (SAWs) in LiNbO3 metamaterials. Based on the analogy between the acoustic wave equation and Schrodinger equation, these metamaterials serve as a platform to rapidly prototype and characterize 2-D quantum materials. By depositing a periodic array of metallic microstructures on LiNbO3, we control SAW propagation, simulating the electronic dispersion of materials with similar lattice geometry. Previous direct visualization of traveling SAWs by laser scanning vibrometry is limited to micron-scale spatial resolution, while microwave impedance microscopy is limited to very narrow frequency ranges. Here, we introduce the use of electrostatic force microscopy (EFM), which achieves sub-micron resolution over a broad bandwidth exceeding 600 MHz. We map the acoustic band structure of graphene-like metamaterials, including a Dirac cone at the K point and a band gap when sub-lattice symmetry is broken. Our technique facilitates faster and more detailed studies of complex SAW metamaterials and, more broadly, enhances the experimental toolkit for band engineering platforms.

Keywords

2D materials | metamaterial | scanning probe microscopy (SPM)

Symposium Organizers

Rajiv Giridharagopal, University of Washington
Benjamin Legg, Pacific Northwest National Laboratory
Ilka Hermes, Leibniz Institute for Polymer Research Dresden e.V.
Shan Zhou, South Dakota School of Mines and Technology

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Session Chairs

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