

Real-space Identification of “Fragile” Quantum Materials

Scientific Achievement

Developed and numerically demonstrated a new theoretical framework for predicting “fragile” topology in natural and artificial materials.

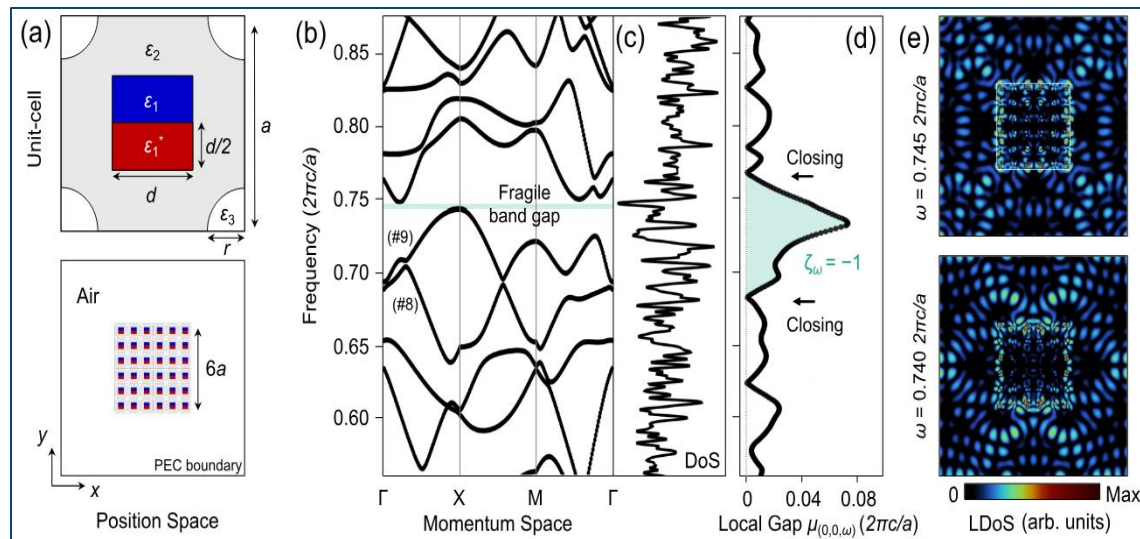


Figure: Classification of fragile topology in a $C_2\mathcal{T}$ -symmetric 2D photonic crystal. The photonic crystal is embedded in air to create a gapless heterostructure. This demonstrates our framework’s ability to be applied to realistic systems beyond simple toy models.

Significance and Impact

Enables the classification of quasicrystals and other aperiodic materials that could not be previously performed.

Research Details

- Used the mathematics of matrix homotopy to derive a real-space invariant for fragile topology.
- Demonstrated its utility in both tight-binding and full wave systems

Lee, K. Y.; Wong, S.; Vaidya, S.; Loring, T. A.; Cerjan, A. Classification of Fragile Topology Enabled by Matrix Homotopy. *Physical Review Research*. 2025.

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