Ripples in the LDOS: When Defects reveal the Band Structure

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Abstract

Band theory describes electrons as independent waves in a periodic potential, distinguishing metals from band insulators. This simple spectral distinction has been challenged recently by the discovery of insulators that carry current in the gap and flat bands that support transport despite vanishing group velocity. Such phenomena derive from multi-band geometrical and topological properties of the waves in reciprocal space, which remain challenging to access experimentally. In this presentation, I will discuss a method to probe band structures directly from local density of states (LDOS) measurements. Point defects in the lattice indeed produce standing-wave interference in the LDOS through elastic scattering. I will show how these ripples can be used to resolve the energy dispersion, measure topological invariants, and ultimately achieve the tomography of Bloch eigenstates, providing direct access to the quantum geometric tensor.

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