Metrology of Band Topology via Resonant Inelastic X-ray Scattering

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Topology is a central notion in the classification of band insulators and characterization of entangled many-body quantum states. In some cases, it manifests as quantized observables such as quantum Hall conductance. However, being inherently a global property depending on the entirety of the system, its direct measurement has remained elusive to local experimental probes in many cases. Here, we demonstrate that various topological band indices can be directly probed by resonant inelastic x-ray scattering. Specifically, we show that the crystalline symmetry eigenvalues at the high-symmetry momentum points, which determine the band topology, leads to distinct scattering intensity for particular momentum and energy. Our approach can be explicitly demonstrated in several examples such as 1D Su-Schrieffer-Heeger chain, 2D quadrupole insulator, 3D topological band insulator and chiral hinge insulator. Our result establishes an incisive bulk probe for the measurement of band topology.