A new paradigm for bulk-edge correspondence

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Abstract

We consider 2d random ergodic Schrödinger operators with long range magnetic fields on domains with and without boundary. By extending the gauge covariant magnetic perturbation theory to infinite domains with boundary, we prove that the celebrated bulk-edge correspondence is just a particular case of a much more general paradigm, which also includes the theory of diamagnetic currents and of Landau diamagnetism. More precisely, we obtain a formula which states that the derivative of a large class of bulk partition functions with respect to the external constant magnetic field is equal to the expectation of a corresponding edge distribution function of the velocity component which is parallel to the edge. Neither spectral gaps, nor mobility gaps, nor topological arguments are required. The equality between the bulk and edge indices, as stated by the conventional bulk-boundary correspondence, is obtained as a corollary of our purely analytical arguments by imposing a gap condition and by taking a "zero temperature" limit. The talk is based on a joint work with H. Cornean and S. Teufel.