Abstract for IAS Focused Program on Mathematical Foundations of Topological Materials (January 6-9, 2026)

From Orbital Magnetism to Bulk-edge Correspondence

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By extending the gauge covariant magnetic perturbation theory to operators defined on half-planes, we prove that for two dimensional random ergodic magnetic Schrödinger operators, the zero-temperature bulk-edge correspondence can be obtained from a general bulk-edge duality at positive temperature involving the bulk magnetization and the total edge current. Our main result is encapsulated in a formula, which states that the derivative of a large class of bulk partition functions with respect to the external constant magnetic field, equals 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-edge correspondence, is obtained as a corollary of our purely analytical arguments by imposing a gap condition and by taking a ``zero-temperature" limit.

This is joint work with Massimo Moscolari (Milan) and Stefan Teufel (Tübingen) https://link.springer.com/article/10.1007/s00023-024-01501-7