THE UNIVERSITY  OF HONG KONG

Institute of Mathematical Research
Department of Mathematics

Numerical Analysis Seminar

Topological insulators and robust edge transport

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Abstract

Surprising asymmetric transport phenomena along interfaces separating insulating bulks have been observed in many areas of applied sciences, e.g., electronics, photonics, and geophysics. Such transport displays quite strong robustness to perturbations as an obstruction to Anderson localization. In fact, the phenomenon affords a topological origin: systems in the same topological class display the same robust, quantized, edge/interface transport. Perturbations may then be interpreted as continuous deformations that preserve the topological class.

This talk considers such systems modeled by general elliptic partial differential operators on the Euclidean plane. We review a recent simple topological classification, which provides an explicit computation of a topological invariant, technically the index of a Fredholm operator obtained by means of confining domain walls. We next introduce a physical observable that allows us to quantify the asymmetry of the edge transport. The evaluation of such an observable is challenging in practice. We then present a bulk-edge correspondence, a pillar of topological phases of matter in the physical literature, which shows that the interface current observable is in fact equal to the aforementioned simple topological invariant.

The theoretical findings are illustrated with examples ranging from electronics applications to geophysical fluid flows.

Date:	November 19, 2024 (Tuesday)
Time:	4:00 pm – 5:00 pm
Venue:	Room 210, Run Run Shaw Building, HKU

All are welcome