

THE PHYSICS COLLOQUIUM

Thursday 14 September 2023, 4:00 p.m.
Nijenborgh 4, Room 5114.0043

Topological Materials for Low-energy Electronics

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The 2016 Nobel Prize in Physics recognized the discovery that phases of electronic matter can differ in the topology of their band structures. This has important implications: Not every insulator (material where the chemical potential is located in a bandgap) is the same, and a boundary which separates insulators of distinct topology must be accompanied by a closing of the bandgap and a conducting boundary mode. These conducting boundaries give rise to new properties of materials, such as the quantum Hall effect in which current is carried without dissipation and the Hall conductance is quantized in multiples of fundamental constants h/e^2 .

Here, I will discuss the potential application of topological material to electronics. The impending end of Moore's Law has prompted a search for a new computing technology with lower energy consumed per operation than silicon CMOS. Topological phases of matter offers a possible solution: a "topological transistor" in which an electric field tunes a material from a conventional insulator "off" state to a topological insulator "on" state, in which topologically protected edge modes carry dissipationless current. Due to the combined effects of Rashba spin-orbit interaction and electric field control of the bandgap, the topological transistor may switch at lower voltage, overcoming "Boltzmann's tyranny".

*Join us for coffee starting 3:30 p.m. Refreshments will be served after the lecture.
For more information contact the host: Antonija Grubisic-Cabo (a.grubisic-cabo@rug.nl)
Website: <http://www.rug.nl/research/vsi/colloquia/>*