Topological connections between quasicrystals and the Quantum Hall problem

Anuradha Jagannathan*[1]

[1]Laboratoire de Physique des Solides - THEO – CNRS, Université Paris Sud, Université Paris Saclay – France

Abstract

It is said that the 1D quasicrystal “inherits” topological properties of the 2D Quantum Hall model. Taking the example of that paradigmatic 1D quasicrystal, the Fibonacci chain, I will introduce its electronic structure, and the so-called gap labels. The topological significance of these latter, identified in the 80s by the the gap labeling theorem, was only recognized rather more recently. They have thus been measured experimentally. However, an explicit computation of Chern numbers was not possible for this 1D system. To compute topological properties, I will present an explicit connection between the quasicrystal and the 2D magnetic problem called the Fibonacci-Hall model. Despite its complex phase diagram, this 2D model permits the determination of the band Chern numbers for periodic approximants of the 1D quasicrystal. This is turn determines the gap Chern numbers.
The Chern numbers of the 1D quasicrystal can thus be seen as a consequence of a ”geometric flux” parameter fS induced by the geometry of winding in 2D space of the quasicrystal. I will discuss how the new method can be generalized to higher dimensional 2D and 3D quasicrystals, where higher order Chern numbers could be computed, and importantly, related to experimentally measurable transport quantities.

*Speaker