Harnessing light to tune the topology of materials

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Abstract

The understanding light-matter interaction has led to many practical applications. Raman spectroscopy, an outstanding tool for graphene characterization, is a prominent example.

But beyond characterization, several studies proposed much deeper effects of laser illumination on the electronic properties of a material like switching off the conduction in graphene [1,2], thereby allowing to tune the material's response with optical means, or even inducing new (tunable) topological phases in otherwise trivial materials [1,3,4] (*i.e.* a *Floquet topological insulator*). The latter is very promising as it would enormously expand the playground of topological insulators to a broader set of materials. Recently, laser-induced bandgaps have been experimentally verified at the surface of a topological insulator [5] adding much thrill to this area.

In this talk I will provide an overview of the recent developments in this field with a focus on the generation of *Floquet chiral edge states* in graphene [6,7] (Fig. 1(a)), bilayer graphene [8] and other materials [9,10]. The emergence of a Hall response without Landau levels [11,12] (see scheme in Fig. 1(b)), similarities and differences with the integer quantum Hall effect (like the breakdown of the connection between usual topological invariants and the Hall conductance [11]), and a few open problems will also be highlighted.

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[12] Related publications and updates available at http://nanocarbon.famaf.unc.edu.ar/

Figures

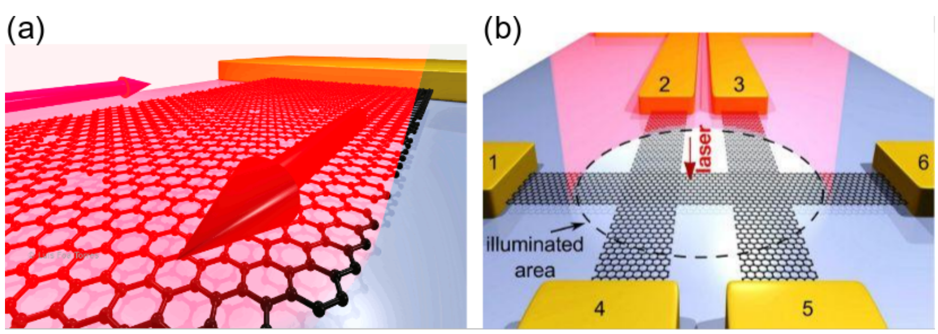

Fig.1: The scheme in (a) represents the chiral edge states predicted in illuminated graphene.
These chiral edge states lead, in a multi-terminal setup as shown in panel (b), to a Hall response.