DEPARTAMENTO DE FÍSICA FUNDAMENTAL

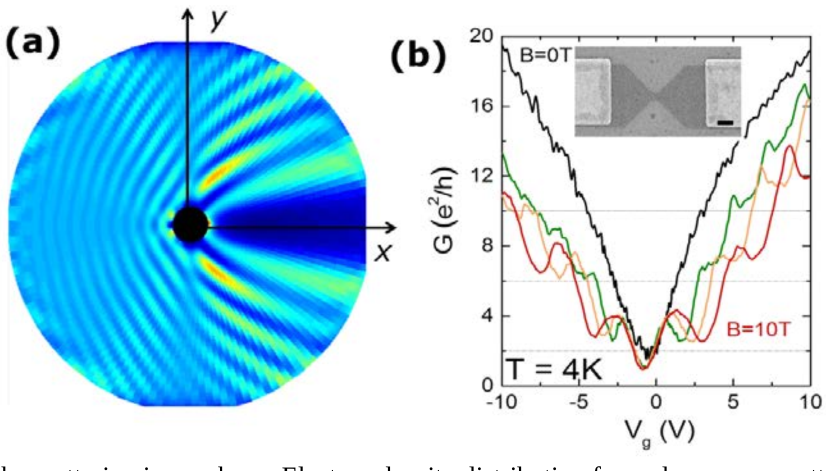
Programa de Doctorado en Física Aplicada y Tecnología

Exploring novel quantum ballistic transport phenomena in graphene

José M. Caridad[1]

[1]*Centre for Nanostructured Graphene, Department of Micro- and Nanotechnology, Technical University of Denmark*

Graphene is the frontrunner of the two-dimensional (2D) materials [1] and offers extraordinary possibilities to explore novel quantum ballistic effects due to the high mobility, confinement and/or relativistic character of its charge carriers. Here, I examine two recent experiments [2,3] displaying unconventional quantum ballistic phenomena in this 2D material. Firstly, guided by the analogy to Mie scattering of light on spherical particles, I show that the propagation of a relativistic-electron wave in graphene can be similarly manipulated by circular potentials acting as quantum dots [2] (Fig.1a). Large dots enable electron lensing and guiding, as demonstrated by the anisotropic propagation of charge carriers in these nanodevices. Such guiding effects survive even at ambient conditions, allowing the technological development of novel electronic systems based on graphene's relativistic-fermions. Secondly, I show that a non-uniform gate-induced charge density in graphene nanoconstrictions introduces new transmission channels within the quantum Hall regime [3] (Fig 1.b). Unlike the standard quantum Hall edge states, these channels are highly susceptible to disorder and break the expected quantization order in graphene. Counterintuitively, the suppression of quantization is most evident for weak edge disorder, and a strong edge disorder reintroduces the expected quantization sequence.



<u>Fig 1.</u>(a) Mie-like scattering in graphene. Electron density distribution for a plane wave scattered on a circular potential (black, 100 nm diameter).. (b) Conductance G vs gate voltage Vg in a graphene nanoconstriction (inset) with a low edge roughness in the quantum Hall regime.

Día: JUEVES, 10 de enero de 2019

Hora: 13:00 horas

Lugar: AULA 11.2 - Edificio I+D+i