

SEMPARIS – Séminaires en région parisienne

<http://string.lpthe.jussieu.fr/semparis/>

Séminaire Matériaux et Dispositifs Quantiques du LPENS

Lundi 14 Février 2022, 13 :30

LPENS, L361

Domaines : cond-mat

Titre : *Guiding Dirac Fermions in Graphene with a Carbon Nanotube*

Orateur : **Jean-Damien Pillet (Ecole Polytechnique)**

Résumé : *Relativistic massless charged particles in a two-dimensional conductor can be guided by a one-dimensional electrostatic potential, in an analogous manner to light guided by an optical fiber. In this seminar, I will present how we use a carbon nanotube to generate such a guiding potential in graphene and create a single mode electronic waveguide. In our architecture, the nanotube and graphene are separated by a few nanometers and can be controlled and measured independently. As we charge the nanotube close to the surface of graphene, we observe in the latter the formation of a single guided mode that we detect using the same nanotube as a probe. I will discuss why the small dimensions of the nanotube and the linear dispersion relation of Dirac fermions gives these electronic waveguides promising characteristics for potential applications. I will also show that, in presence of magnetic field, our electronic waveguides host discrete electronic levels resembling Landau levels of 2D Dirac particles but with no C-symmetric counterpart, i.e. they exist only for one sign of energy, positive or negative, depending on the voltage applied on the nanotube. This unusual behavior is a generic signature of Dirac surface states, which are predicted to be protected to a great extent to surface disorder.*
