DEPARTAMENTO DE FÍSICA FUNDAMENTAL

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Towards the QAHE: induced magnetism in exfoliated graphene via proximity effect with yttrium iron garnet thin films

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The recent discovery of the quantum anomalous Hall effect (QAHE) in magnetically doped topological insulators at millikelvin temperatures is an important breakthrough in the field of spintronics. It has been predicted that QAHE should occur in graphene proximity-coupled to a ferromagnetic insulator at temperatures that will be suitable for practical applications.

Hints of proximity-induced magnetism in graphene coupled to yttrium iron garnet (YIG) films have been reported, however the QAHE was not observed. The lack of a fully developed plateau in graphene/YIG devices has not been fully addressed but can be attributed to poor interfacial coupling resulting in a dramatically reduced magnetic proximity effect. Therefore, it is essential to understand completely the interfacial coupling between YIG and graphene. Here we report the growth of atomically flat epitaxial thin-films of YIG on lattice-matched gadolinium gallium garnet substrates by pulsed laser deposition. The films are extensively characterized by a combination of X-ray diffraction, X-ray reflectivity, atomic force microscopy, vibrating sample magnetometry and ferromagnetic resonance. Mechanically cleaved single layer graphene flakes are deterministically deposited onto the YIG and characterized by Raman spectroscopy and atomic force microscopy. The careful placement of graphene on the YIG and the investigation of the graphene/YIG interface are a necessary step towards the demonstration of QAHE at higher temperatures than previously reported.

Día: Jueves 28 de abril de 2016
Hora: 12:00 horas
Lugar: AULA VI (TRILINGÜE)