



ID de Contribution: 241

Type: Contribution orale

Singular orbital magnetism in Graphene with a moiré potential

mercredi 5 juillet 2023 08:30 (30 minutes)

A singular Landau orbital magnetism of graphene, with a sharp narrow diamagnetic peak at the Dirac point was already predicted in 1956 by McClure. It is now understood as a fundamental signature of the characteristic Berry phase of graphene's electronic wave functions.

Using a highly sensitive giant magnetoresistance (GMR) sensor, we have measured the gate voltage-dependent magnetization of a single graphene layer. The signal exhibits a sharp diamagnetic peak at the Dirac point whose magnetic field and temperature dependences agree with long-standing theoretical predictions. These measurements enable the investigation of orbital currents in 2D materials that cannot be detected in usual transport measurements. Among the predictions an intriguing orbital paramagnetism at saddle points of 2D materials is also expected.

In order to reveal this unusual orbital paramagnetism, we investigated graphene layers aligned with the hexagonal lattice of a boron nitride substrate, giving rise to a large period moiré potential acting on graphene charge carriers. Beside the sharp diamagnetic peak at the Dirac point, followed by de Haas-van Alphen oscillations at larger doping, we detect extra diamagnetic peaks at the satellite Dirac peaks of the moiré lattice. We also find paramagnetic peaks surrounding these satellite diamagnetic peaks related to van-Hove singularities in the density of states. These findings confirm the existence of paramagnetic orbital loops in 2D systems when the Fermi energy is tuned in the vicinity of saddle points.

J. Vallejo-Bustamante et al. Science 2021 and arXiv:2303.17500

Affiliation de l'auteur principal

LPS Orsay CNRS Université Paris Saclay

Auteurs principaux: Dr PIECHON, Frederic (LPS Orsay); Prof. MONTAMBAUX, Gilles (LPS Orsay); BOUCHIAT, Helene (LPS Orsay); FUCHS, Jean-Noël (LPS Orsay); M. VALLEJO-BUSTAMANTE, Jorge (C2N Université-Paris Saclay); Dr FERRIER, Meydi (LPS Orsay); Dr RIBEIRO, Rebeca (C2N Université-Paris Saclay); Dr DEBLOCK, Richard (LPS); Dr GUERON, Sophie (LPS Orsay); Dr GUÉRON, Sophie (LPS Orsay)

Orateur: BOUCHIAT, Helene (LPS Orsay)

Classification de Session: Mini-colloques: MC20 Physique mésoscopique

Classification de thématique: MC20 Physique mésoscopique