

The Hebrew University of Jerusalem , Condensed Matter Seminar

Prof. Efrat Shimshoni

Bar Ilan University

Danciger B Building, Seminar room

"Superfluid-Insulator transition of quantum Hall domain walls in bilayer graphene"

The quantum-Hall ferromagnetic state of bilayer graphene at zero filling, when subject to a kink-like perpendicular electric field, manifests domain walls in the electronic state and low-energy collective modes confined to move along them. In particular, it is shown that two pairs of collective helical modes are formed at opposite sides of the kink, each pair consisting of modes with identical helicities. We derive an effective model for the quantum dynamics of these modes in terms of two weakly coupled anisotropic quantum spin-ladders, with parameters tunable through control of the electric and magnetic fields. This yields a rich phase diagram, where due to the helical nature of the modes, distinct phases possess very different charge conduction properties. Most notably, this system can potentially exhibit a transition from a superfluid to an insulating phase.