Tunable Edge Magnetoplasmon Resonator

Elric Frigerio*†[1], Mélanie Ruelle , Giacomo Rebora , Yong Jin , Ulf Gennser , Antonella Cavanna , Jean-Marc Berroir , Plaçais Bernard , Pascal Degiovanni , Gwendal Fève , and Gerbold Ménard‡

[1]lpens – LPENS – France

Résumé

Edge magnetoplasmons (EMPs) are the low-energy excitations of a 2DEG in the Quantum Hall regime. These chiral collective excitations propagate along the electrostatic edge of the 2DEG at a velocity v fixed by the magnetic field B: v α 1/B (1). In an isolated Hall island, these trajectories are closed loops, making it possible to create a resonant cavity for EMPs. Such resonance depends on both the velocity v of the EMPs and the perimeter L of the cavity through the relation f=v/L.

Since the EMPs propagate along the edge of the Hall Island, it is possible to tune the resonant frequency by changing the perimeter of the resonator. Varying the perimeter is made possible by a set of QPCs and top gates deposited on the sample. Applying a strong enough potential on a top gate changes locally the electronic density of the 2DEG and a new edge arises at the interface. With a few top gates, it is possible to design various cavities in the same sample, thus changing the resonance frequency.

The cavity must be isolated for the resonance to happen: there must be no ohmic contact to the rest of the 2DEG. This isolation forbids any ohmic contact between the resonator and the rest of the environment: the 2DEG must thus be excited capacitively (via a top gate). In this work we present our results on tunable micrometer-sized resonators with resonances in the GHz range. We show that the size of the cavity can be modulated and that we can achieve a multi-modes regime.

*Intervenant

†Auteur correspondant: elric.frigerio@phys.ens.fr

‡Auteur correspondant: gerbold.menard@phys.ens.fr