Tunable Edge Magnetoplasmon Resonator

Quantum Hall (QH) systems are platforms of choice when it comes to study topological properties of condensed matter systems. Edge magnetoplasmons (EMPs) are the low-energy excitations of a 2DEG in the QH regime. These chiral collective excitations propagate along the electrostatic edge of the 2DEG at a velocity v fixed by the magnetic field B. 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 QH 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.
In this seminar, we present our results on tunable micrometer-sized resonators with resonances in the GHz range and we show how the gates couple capacitively to the QH island. This allows us to fully control the properties of our resonator, making it possible to develop an EMP interferometer. Such device would be a valuable tool to investigate the properties of quasiparticles in the fractional QH regime.