Magnetoplasmons in quasi-neutral epitaxial graphene nanoribbons

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We report on infrared transmission spectroscopy study of magnetoplasmons in quasi-neutral epitaxial graphene nanoribbon arrays [1]. The energy of the $L_{0(-1)} \rightarrow L_{1(0)}$ inter-Landau level transitions deviates from the characteristic $\sqrt{B}$ dependence observed in two-dimensional graphene. This behavior is explained as a signature of the upper hybrid mode formed between the Landau level transition and the plasmon resonance. The study of this hybrid mode allows us to probe the zero magnetic field plasmon resonance in the interacting regime, when a the strong decay of the plasmon mode induced by the coupling to electron-hole excitations takes place. The observed energy shift exhibits a peculiar ql_B^2 scaling behavior, which distinguishes it from the upper-hybrid mode in conventional two-dimensional systems and in highly doped graphene [3].

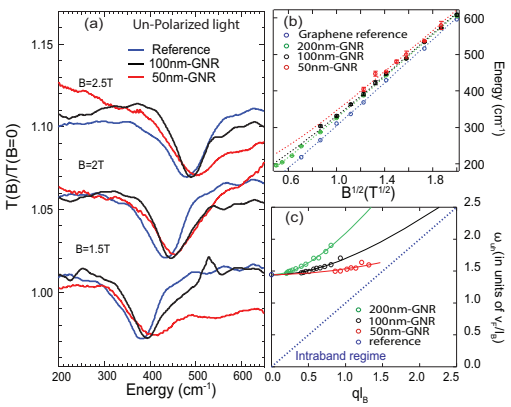

Figure 1: (a) Normalized magneto-transmission spectra of 2D graphene (blue), 100-nm-wide (black) and 50-nm-wide (red) Graphene nano ribbon (GNR) arrays measured with un-polarized IR light and at different magnetic fields. (b) $\hbar\omega_{uh}$ versus $\sqrt{B}$ for 2D graphene, 200-nm-wide, 100-nm-wide, and 50-nm-wide GNR array samples, a clear deviation from the linear behavior in observed for the GNR samples, following [2]. (b) Dispersion relation of the UHM, $\omega_{uh}(ql_B)$, in units of v_F/l_B. The data taken on the 2D graphene collapse on a single point (blue circle) at q=0. Dotted blue line indicates the boundary between the interband and intraband regimes.

[1] J. M. Poumirol et al. manuscript submitted to Phys. Rev. Lett.
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