Laboratoire Matériaux et Phénomènes Quantiques

SEMINAIRE GÉNÉRAL

THz Ultrastrong light matter coupling: from few electrons to magnetotransport control

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Hybrid excitations, called polaritons, emerge in systems with strong light-matter coupling. Usually, they dominate the linear and nonlinear optical properties with applications in quantum optics [1,2]. In this talk, I will discuss two experiments: in the first one, we show how we can engineer metasurfaces operating in the THz range with nanogaps which enable ultrastrong coupling to a small number of electrons (<100) [3]. In the second one we highlight the crucial role of the electronic component of polaritons in the magneto-transport of a cavity-embedded 2D electron gas in the ultrastrong coupling regime. We show that the linear dc resistivity is significantly modified by the coupling to the cavity even without external irradiation [4]. Our observations confirm recent predictions of vacuum-induced modification of the resistivity. Furthermore, photo-assisted transport in presence of a weak irradiation field at sub-THz frequencies highlights the different roles of localized and delocalized states.

[1] A. Wallraff et al., Nature, Nature 431, 162-167 (2004), Y. Todorov et al., Phys. Rev. Lett. 102, (2009)
[2] C. Ciuti et al., Phys. Rev. B 72, 115303 (2005)
[3] J. Keller, G. Scalari et al., Nano Letters, 17 (12), 7410 (2017)
[4] G.L. Paravicini-Bagliani et al., Nature Phys., in press (2018)

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