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Szkoła IN : Friday 20th of November 2015, g. 10:15-12:00, room 0.06, Pasteura 5, Faculty of Physics University of Warsaw

Cavity light-matter coupling in solid state systems has been recently approaching the ultrastrong coupling regime [1-4], where the Rabi frequency Ω is comparable to the bare excitation frequency ω.. We recently demonstrated a new platform to investigate ultrastrong coupling physics: the cyclotron transition of a 2DEG is coupled to an Au metasurface of THz split-ring resonators reaching the ultrastrong coupling regime and showing record high values of the light-matter coupling ratio Ω / ω =0.58 [5]. I will present our recent advances in this polaritonic system. We employ Nb-based superconducting complementary metasurfaces [6] achieving adiabatic modulation of the polaritonic states through temperature tuning. With the same kind of cavities and a sample with n=4 quantum wells we observe a record-high normalized coupling ratio of Ω / ω =0.89 [7] at a frequency of 300 GHz. For such value the polaritonic dispersion clearly deviates from the linear regime. I will discuss also an high quality factor complementary THz metasurface based on Niobium thin film [8], whch displays narrow resonance and Q factor higher than 50 at T=3 K in a strongly subwavelength volume (V_{cav}/lambda^3 of the order of 10^{-6}). I will present new experimental results obtained measuring these metasurfaces at temperatures as low as 20 mK, where Q factors as high as 120 are measured. Our measurements highlight the role of the residual normal state electrons at temperatures well below the critical temperature T
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