Near-Field spectroscopy investigation of the strong coupling between an infrared nanoantenna and a semiconductor quantum-well

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The strong light-matter coupling is an exotic phenomenon of interest not only for basic physics, but also because of its potential for improving optoelectronic devices. Electrons in semiconductor quantum wells (QWs) display narrow intersubband (ISB) transitions in the far- and mid-IR that can couple to the optical resonances of metallic nanoantennas. Strong light-matter coupling appears in the form of new hybrid eigenmodes, called *intersubband cavity polaritons* that share both light and matter character. Here we present the strong-coupling study between an ISB transition in a semiconductor QWs and a plasmonic resonance in a *single* mid-IR patch antenna. The signature of this regime is the characteristic anti-crossing of the “light” and “matter” excitations when the two resonances spectrally overlap. We perform nano-infrared spectroscopy at the single resonator level, with the aim of understanding the microscopic mechanisms that lead to the strong coupling regime.