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Light-matter interaction in hybrid plasmonic-photonic resonators

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Plasmonic antennas and high-Q cavities are two polar opposite strategies to increase light matter interaction strength, aiming either at broad bandwidth operation at the price of Ohmic loss, or at loss-free operation, at the price of narrow bandwidth. Hybridizing antennas and cavities at first sight is a poor idea, yet in this talk I argue that in some combinations one can obtain plasmonic mode volumes at cavity Qs, and at reduced Ohmic loss. I discuss an experiment in which we show that cavitys with a Q of 10^8 can improve in Q upon introduction of metal particles. Also, I will present calculations that show that hybrids will show Fano lineshapes in local density of states (or Purcell factor), with large spontaneous emission rate enhancements over Qs of order 1000. Finally I discuss our efforts to fabricate and optically characterize hybrid structures, and touch upon the physics of multiple antennas coupling through a single cavity.