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Engineering the coherent coupling of single emitters with light

We examine the coherent interaction of strongly confined light with a single molecule at cryogenic temperatures [1, 2, 3] and show that a single molecule can leave a fingerprint larger than 10% on a laser beam. Furthermore, we discuss experiments and theoretical calculations for enhancing the coupling between a single molecule and light. We show how a single spherical gold nanoparticle can act as a nano-antenna to modify the excitation, radiation and dissipation processes of a single molecule by more than an order of magnitude [4] and provide guidelines for designing more complex antenna structures that result in even larger effects [5]. We also discuss an experiment which aims at the coupling of two independent Fourier-limited single photon sources [6].

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