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Towards hybrid quantum information in weak-coupling solid-state cavity QED systems[1] JAN GUDAT, DAPENG DING, CRISTIAN BONATO, SUMANT OEMRAWSINGH, University of Leiden, SUSANNA THON, HYOCHUL KIM, University of California, Santa Barbara, MARTIN VAN EXTER, University of Leiden, DIRK BOUWMEESTER, University of California, Santa Barbara — Quantum dots in oxide-apertured micropillar cavities are robust high-Q structures to implement solid-state cavity quantum electrodynamics (QED) and quantum information schemes involving single photons and the spin of a single confined electron. The electron spin interacts with the optical field through the trion state (two electrons-one hole). We discuss spin-selective photon reflection in the weak coupling cavity-QED regime and hybrid photon-electron spin schemes for implementing quantum gates. We discuss the practical implementation of the proposed schemes. In particular we show experimentally that the oxide-apertured micropillar cavities exhibit high-quality Hermite-Gaussian modes and that such modes can be permanently tuned, up to 150GHz, by introducing strain via optically induced surface deformations.

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