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Efficient generation of indistinguishable single photons on-demand at telecom wavelengths JEHYUNG KIM, TAO CAI, Univ of Maryland-College Park, CHRISTOPHER RICHARDSON, RICHARD LEAVITT, Laboratory for Physical Science, EDO WAKS, Univ of Maryland-College Park — Highly efficient single photon sources are important building blocks for optical quantum information processing. For practical use and long-distance quantum communication, single photons should have fiber-compatible telecom wavelengths. In addition, most quantum communication applications require high degree of indistinguishability of single photons, such that they exhibit interference on a beam splitter. However, deterministic generation of indistinguishable single photons with high brightness remains a challenging problem in particular at telecom wavelengths. We demonstrate a telecom wavelength source of indistinguishable single photons using an InAs/InP quantum dot in a nanophotonic cavity. To obtain the efficient single quantum dot emission, we employ the higher order mode in L3 photonic crystal cavity that shows a nearly Gaussian transverse mode profile and results in out-coupling efficiency exceeding 46 % and unusual bright single quantum dot emission exceeding 1.5 million counts per second at a detector. We also observe Purcell enhanced spontaneous emission rate as large as 4 and high linear polarization ratio of 0.96 for the coupled dots. Using this source, we generate high purity single photons at 1.3 μm wavelength and demonstrate the indistinguishable nature of the emission using a two-photon interference measurement.

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