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(G*) Multiplexed Single-Photon Source Based on Multiple Quantum Dots Embedded within a Single Nanowire

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Non-classical light sources are an important tool for many quantum information processing applications such as quantum key distribution and linear optical quantum computing. Sources based on semiconductor quantum dots offer close to ideal performance in terms of efficiency and single photon purity. However, emission rates are limited by the radiative lifetime of the excitonic complexes. This limitation can be overcome by multiplexing independent quantum dot emitters. Here we propose an approach to deterministically integrate multiple single photon emitters within a single photonic structure based on bottom-up grown nanowires. We use selective-area vapour-liquid-solid epitaxy to incorporate five energy tuned quantum dots in a single nanowire photonic waveguide, all of which are all optimally coupled to the same optical mode. Each dot acts as an independent source of high purity single photons and the total emission rate is found to scale linearly with the number of embedded emitters. This result is an important step towards producing wavelength multiplexed single photon sources where the emission rate is limited by the number of incorporated emitters.

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