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Single-photon emitter using a rare-earth atom confined in optical fiber

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Abstract

Rare-earth atoms in solid-state materials are attractive components for photonic quantum information systems because of their coherence properties even in high-temperature environments. We experimentally perform the single-site optical spectroscopy and optical addressing of a single rare-earth atom in an amorphous silica optical fiber at room temperature with two kinds of rare-earth atoms. The autocorrelation function of photons emitted from a single rare-earth atom shows a direct evidence of the generation of really single photons. The time width of the autocorrelation function is phenomenologically explained by the model of a three-level system, and is determined in practice by the pump rate of the single rare-earth atom. The ability to address single rare-earth atoms provides a very stable and cost-effective technical platform for the realization of a solid-state system especially for single-photon emitters with a large number of spectral channels from visible to mid-infrared wavelengths.