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Broad-band sources of single-photon pulses, based on spontaneous parametric scattering in nonlinear impurity crystals

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Abstract

This paper discusses the possibilities of using spontaneous parametric scattering (SPS) in impurity crystals with a periodic domain structure for the efficient generation of narrow-band single-photon pulses. Using a periodically poled potassium titanyl phosphate crystal doped with trivalent erbium ions as an example, it is shown that, in the case of a nonlinear crystal with a periodic domain structure, allowing the generation of photons on the opposite sides, the width of the SPS spectrum can be less than the free spectral zone of a single-cavity parametric generator based on this crystal. Such an SPS regime can be useful when creating narrow-band sources of single-photon states that can be recorded and reproduced in optical quantum-memory devices, as well as for combining SPS processes and quantum memory in a single medium-a nonlinear impurity crystal.

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