High performing SPS based on native NIR-emitting single colour centers in diamond

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ABSTRACT

Single-photon sources (SPS) play a key-role in many applications, spanning from quantum metrology, to quantum information and to the foundations of quantum mechanics. Even if an ideal SPS (i. e. emitting indistinguishable, "on-demand" single photons, at an arbitrarily fast repetition rate) is far to be realized due to real-world deviations from the ideality, much effort is currently devoted to improving the performance of real sources. With regards to the emission probability, it appears natural to employ sources that are in principle deterministic in the single-photon emission (single quantum emitters such as single atoms, ions, molecules, quantum dots, or color centers in diamond) as opposed to probabilistic ones (usually heralded SPS based on parametric down-conversion). We present an overview of our latest results concerning a work-in-progress NIR pulsed single photon source based on single quantum emitters (color centers in diamond) exploiting recently reported centers. They are particularly interesting because of the narrow emission line (tipically less than 5 nm), the shorter excited state lifetime with respect to NV centres (1 - 2 ns compared to 12 ns, allowing a ten-fold photon emission rate upon saturation) and the polarized emission.

Keywords: Single-photon source, confocal microscopy, diamond

1. INTRODUCTION

One of the open issues of the state of the art of quantum technology is the realisation of reliable, almost ideal Single-photon sources (SPS) and their optimization. Ideally a SPS should have three characteristics: it should be on demand (the emission time should be arbitrarily defined by the user, possibly with arbitrarily high rate), the probability of emitting zero or more than one photon in a proper time window should be zero, and subsequent photons should be indistinguishable. This goal is of course asymptotical and could not be likely met in the

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