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Ultrafast heralded single photon source based on telecommunication technologies

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Quantum information science (QIS) is a pioneering field of research at the interface of physics and information science. By harnessing the unique properties of quantum mechanics to code, transmit and process information, QIS offers significant opportunities to revolutionise information processing and communication strategies : the quantum analogue of a bit is the Qbit.
Of the various physical systems currently investigated, single particles of light (photons) are destined to play a central role due to their inherent low decoherence, ease of manipulation at the single photon level and light-speed transmission. Photonics Qbits can be conveniently generated through the process of spontaneous parametric down-conversion, whereby a photon from a laser beam incident onto a non-linear crystal can spontaneously split into two daughter photons, conserving momentum and energy. Our approach aims at exploiting the high-maturity of both telecom and integrated non-linear optics as enabling technologies. This should lead to the demonstration of ultrafast photon-pair sources, as well as, when one of the photon is used as a trigger, of ultrafast heralded Fourier transform single photon sources, all in a guided-wave fashion.

In this talk, we will present a photon pair source, based on high-brightness periodically poled lithium niobate waveguide, pumped by a state-of-the-art telecom laser operating at a repetition rate of 10 GHz. We will also show how high quality telecommunication components enable the implementation of an ultrafast Fourier transform limited heralded single-photon source complying with the demand of next generation high bit rates quantum networks.