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Metrological Characterisation of Single-Photon Avalanche Diodes

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Single-photon avalanche diodes (SPADs) are currently the most used detectors for the single-photon detection in many quantum technologies, such as quantum communication, quantum key distribution, quantum biology, etc. [1, 2]. The success of such technologies greatly depends on the performance of the single-photon detector used. In the last decade, the performance of such SPAD detectors, e.g. quantum efficiency, dead time, dark counts, gating rate, etc., has been significantly improved due to the great advances in new avalanche quenching technologies and cooling systems [2, 4]. Basically, two types of SPAD detectors are nowadays commercially available: gated and free-running SPAD detectors [5, 6]. In both cases, the metrological characterization of their optical parameters is essentially required to fully guarantee the reliability of the quantum detection system. Therefore, the PTB, and other National Metrological Institutes (NMIs), are putting great efforts in developing novel measurement methods and calibration facilities, which allow the traceable characterization of the optical parameters of these detectors by using reference standards [7, 8]. In this conference, the detailed metrological characterization of Si- and InGaAs- SPAD detectors including the measurement setup, traceability and uncertainty analysis will be presented.

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