Consiglio Nazionale delle Ricerche

SPIN

Superconducting Quantum Detectors

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An overview of current research activities of SPIN in the area of Superconducting Quantum Detectors will be given in the context of the state of the art of quantum science and technologies. The focus will be on two current research topics that are currently pursued: photon number counting and long wavelength single photon detection. We approach the first one at 1550 nm by using a segmented approach unique to superconducting detectors, i.e. sub-wavelength scale segmentation that achieves uniform detection efficiency for each segment. Instead for long wavelength single photon detection we face the issue of decreased photon energy which makes detection significantly harder. Currently, the limit of NbN-based SNSPDs seems to be around 2.0 μm beyond which the single photons are not detected anymore. For this reason, we investigate new materials (mainly ultrathin MoSi and NbRe) in a microstrip detection configuration. Single photon detection in these devices occurs through a different detection mechanism which could enable the realization of large area devices with unprecedented sensitivity. Finally, we will show some recent results and outline which possible applications we are pursuing with our Superconducting Quantum Detectors. These activities can be divided into three main categories: 1) Quantum characterization of light sources (using photon number resolving detectors), detectors (timing jitter and quantum state reconstruction fidelity) and QKD systems (usage of SNSPDs in long distance QKD systems), 2) LIght Detection And Raning (LIDAR) for atmospheric monitoring, where we have performed the first investigation of the atmosphere in a multi-wavelength LIDAR system using a high efficiency SNSPD multimode fiber coupled readout channel and 3) Investigation of fundamental properties of thermal light, such as heralded photon number doubling.