

Singlet Oxygen Luminescence Detection with a Superconducting Nanowire Single-photon Detector

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Abstract — Superconducting nanowire single photon detectors (SSPDs/SNSPDs) are a highly promising infrared single photon detection technology, with free running operation, low dark counts and high timing resolution. We have applied SNSPDs to a new application in the life sciences and medicine, namely the direct monitoring of singlet oxygen luminescence at 1270 nm wavelength. Singlet oxygen is an excited state of the oxygen molecule, a crucial intermediate in many biological processes. We recorded luminescence from a photosensitizer solution using a fiber-coupled SNSPD optimized for 1270 nm wavelength installed in a practical closed-cycle refrigerator. Narrow band spectral filtering and chemical quenching was used to verify the singlet oxygen signal, and lifetime evolution with the addition of protein was studied. Furthermore, we demonstrated the detection of single oxygen luminescence through a single optical fiber, a marked advance for dose monitoring in clinical treatments such as photodynamic cancer therapy.