ENSURE

Electrical nanodiamond single-photon source

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Project context and objectives

The ability of optoelectronic devices to operate at a single-photon/single-electron level will result in the ultimate energy efficiency and in a wide range of novel applications in optical data processing, optical communications, sensing and spectroscopy. In addition, room temperature operation is essential, since only in this case the net energy efficiency is high and integration in complex optical and photonic systems is reasonable. The possibility of operation upon electrical injection was not clear for diamond, mainly because diamond is a unique material at the interface between solid-state and semiconductor physics and can demonstrate effects from both of these worlds, but the recently demonstrated electroluminescence and single photon emission from nitrogen vacancy color centers in diamond have proven the concept. In this seed project, guided by the theory for electroluminescence of color centers in diamond that has been recently developed, we laid the ground for the experimental realization of a novel electrically pumped single-photon source in diamond, whereby the metal electrode acts as a nanooptoelectronic element that enhances single-photon emission by 3 orders of magnitude compared to recent results.