Enhancement of the optical signal from nitrogen vacancy centres by coupling to surface plasmons in nanostructures

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Nitrogen vacancy (NV) centers in diamonds are being used to measure magnetic fields with high precision and also to image magnetic fields (see [1] for a recent review). A typical magnetic field measurement involves polarizing the triplet ground state optically to the ms=0 state by irradiating the diamond with green light. The ms=0 and ms=+/-1 states have a zerofield splitting of 2.87 GHz and the energies of the ms=+/-1 are shifted by 2.8 MHz/G by a local magnetic field. The intensity of the red fluorescence is more intense for the ms=0 state than from the ms=+/-1 states. Coherent superposition of states can be created with suitable sequences of microwave pulses, and their evolution in a magnetic field leads to phase changes that yield information about the magnetic field strength. We are studying new ways to enhance fluorescence from NV centres by coupling them to plasmon-active nanostructures [2]. Two possible approaches exist: NV centres in nanodiamonds can be brought near plasmonactive AAO nanostructures [3] or plasmon-active nanostructures such as suspensions of nanoparticles could be distributed over bulk diamond.

References

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Participation in EuroNanoForum 2015 is supported by ERAF project No. 2015/0008/2DP/2.1.1.2./14/APIA/VIAA/004