

SE-02-01

Quantum sensing at nanoscale enabled by diamond spin qubits

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Abstract

Synthetic diamond has recently emerged as a candidate material for a number of quantum applications, including quantum information processing and quantum sensing. In this talk, I will show how single nitrogen-vacancy (NV) colour centres can be created near the diamond surface and used as nanoscale sensors of electric and magnetic fields. I will also demonstrate novel dynamical decoupling techniques allowing to improve the sensitivity of diamond quantum sensors and discuss applications of small-scale quantum registers for nanoscale NMR. Applications of NV centres for hyperpolarisation of nuclear spins and application of optical spin polarisation in MRI will be presented.