

Nanoscale Sensors Based on NV Centers in Diamonds: Metrology, Biomedical Applications and Remaining Challenges

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Nitrogen-vacancy centres in diamond are the subject of intense investigation due to their unique quantum properties and multifunctional sensing capabilities. Their optical addressability, high sensitivity, and intrinsic biocompatibility enable local, nanoscale measurements of key physical quantities, including temperature, magnetic and electric fields, making them highly attractive for quantum metrology and biomedical sensing. In this work, we present recent advances achieved within a collaboration between the Italian National Metrology Institute (INRiM), the University of Turin, and the Italian National Institute for Nuclear Physics (INFN), focusing on the development and application of diamond-based quantum sensors in metrology and biological systems. We highlight experimental demonstrations of intracellular thermometry, novel sensing schemes for metrology based on dressed spin states, and advances in nanodiamond production for biological applications.

References

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