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Title: **Determination of the central resonance frequency of the ODMR signal in a quantum thermometer using the linear regression method**

The presented research was carried out using the optically detected magnetic resonance method (ODMR) on a sample of microdiamonds with negatively charged nitrogen-vacancy (NV^-) colour centres.

Diamonds with NV^- colour centres are widely used in quantum metrology due to their unique properties. The electronic level of NV^- colour centres is highly sensitive to external conditions, particularly temperature [1] and magnetic field [2]. High photostability, long coherence and low cytotoxicity [3] enable thermal measurements in room temperature, which find their particular application in medical diagnostics involving living organisms [3].

Earlier research conducted in Division of Quantum Engineering and Metrology at Poznan University of Technology [1] demonstrated the temperature dependence of the ODMR signal shift over a wide temperature range. Currently presented study focuses on detecting of the ODMR signal shift within a narrow range of temperatures corresponding to the range of mammals' internal body temperatures.

Up to this point, the resonant frequency of ODMR signal was determined by fitting a double pseudo-Voigt, Gaussian, or Lorentzian function to the signal using non-linear regression. Each of these approaches is accurate enough to efficiently analyse the signals, however due to high computational complexity this process is highly time consuming. To reduce processing time, it was necessary to improve the process of computing the resonant frequency. For this purpose, the fact that differential ODMR signal exhibits nearly linear behaviour in the vicinity of the resonance frequency was utilised. Fitting a linear function with linear regression method enables accurate determination of the resonance frequency, while requiring significantly less time.

References

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