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Spectrum analyzer based on NV centers in diamond

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The Nitrogen Vacancy (NV) centers are considered, for their optical and spin proprieties, promising candidates for quantum sensing applications. In this work, the spin-dependent optical proprieties of a NV centers ensemble are exploited in order to realize a spectrum analyzer.
To do that, a static magnetic field gradient, generated by a permanent magnet, induces a spatial dependent Zeeman shift to the NV centers present in the diamond: the NV center resonance frequency is so correlated to a defined position in the diamond. A wide field imaging system collects the fluorescence of the NV centers while they are continuously pumped by a green (532nm) laser. A microwave magnetic field, resonant with the NV center transition, will cause a drop of photoluminescence, visible on the image, at a well-defined position. Knowing the static magnetic field at that position, the microwave frequencies can be deduced.
The device is able to achieve a dynamic range of 30dB, a frequency range of 25 GHz and a limit resolution (frequency dependent) of 1 MHz. The Nitrogen nuclear spin polarization by pure optical
means near both ground state and excited state level anti-crossing has been also investigated. A quite large range of polarization efficiency has been observed, allowing a better frequency resolution.

Language

English

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