Imaging, Tracking and Magnetic Resonance of Nanodiamond Sensors in Liquids

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Nanodiamonds are versatile quantum sensors for biological studies, owing to the quantum coherence of spins in diamond and the biocompatibility of the material. For studies in live biological systems, it is highly desirable to track moving and rotating nanodiamond sensors in liquid and to minimize the phototoxicity. We show two optical techniques to achieve such goals. One is optical detection of magnetic resonance using light-sheet illumination, which allows for a wide-field, vertically scannable imaging and sensing in live cells with reduced phototoxicity. Another technique is the simultaneous fast tracking of multiple nanodiamonds in liquid using digital micromirror devices, which allow multi-focus random access of nano-sensors moving in liquid samples. We demonstrate the techniques using prototype applications.

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