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Distance measurement based on electron spin decoherence time (T2) SUSUMU TAKAHASHI, DEVIN EDWARDS, SONGI HAN, MARK S. SHERWIN, University of California Santa Barbara — Magnetic resonance techniques have been used for applications to magnetic imaging sensors with nanometer and sub-nanometer scale and for determination of static and dynamical structure of biological molecules. Among the methods, electron spin resonance (ESR) brings important capabilities which nuclear magnetic resonance (NMR) cannot access to. The examples include a long distance determination up to several nanometers and a fast time resolution with hundreds of nanoseconds. Currently several advanced pulsed and continuous wave (cw) ESR techniques are commonly used to determine distance with low frequency ESR. We have recently demonstrated that high frequency pulsed ESR can well-characterize the strength of magnetic dipolar interaction between electron spins through spin decoherence time (T2) [1]. This result implies that investigation of spin decoherence time by high frequency ESR can be used for distance measurement. We will present a principle of this new distance measurement technique and will determine an average distance of impurities in diamond. In addition, bio-related applications will be discussed.

[1] S. Takahashi et al., *Phys. Rev. Lett.* **101**, 047601 (2008).

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