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Polarization-selective excitation of nitrogen vacancy centers in diamond T. P. MAYER ALEGRE, Laboratorio Nacional de Luz Sincrotron, C. SANTORI, Hewlett-Packard Laboratories, G. MEDEIROS-RIBEIRO, Laboratorio Nacional de Luz Sincrotron, R. G. BEAUSOLEIL, Hewlett-Packard Laboratories
— The nitrogen-vacancy (N-V) center in diamond is promising as an electron spin qubit due to its long-lived coherence and optical addressability. Nevertheless, some work remains in determining the detailed energy level structure. In particular, little emphasis has been put on the microwave polarization selection rules. In typical optically-detected magnetic resonance (ODMR) experiments, the microwave transitions are driven by linearly polarized fields. Thus the individual transitions can be selected only by applying a constant magnetic field to lift the degeneracy. Typically the magnetic field is applied along the quantization axis of the NV center to avoid mixing of the spin states. This applied magnetic field is in principle unnecessary with circularly polarized microwave excitation. Using a resonator designed to produce circularly polarized microwaves, we have investigated the polarization selection rules of the N- V center. We first apply this technique to N-V ensembles in [100] and [111]-oriented samples. Next, we demonstrate an imaging technique, based on optical polarization dependence, that allows rapid identification of the orientations of many single N-V centers. Finally, we test the microwave polarization selection rules of individual N-V centers of known orientation.

Thiago P. Mayer Alegre
Laboratorio Nacional de Luz Sincrotron

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