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Nitrogen Vacancy centers in diamond as θ^2 sensors[1] SHONALI DHINGRA, BRIAN D'URSO, University of Pittsburgh — Nitrogen-vacancy (NV) centers are naturally occurring defects in diamond, which feature an electronic spin with well-defined quantum behavior, including long quantum coherence times and optical addressability. In this work, we show how to align an external magnetic field to the direction of the internally-defined spin axis of the NV center. We further show that this capability can be explored to use an NV center as a θ^2 sensor in presence of this external magnetic field. The sensitivity of this sensor is shown to increase very rapidly with the external magnetic field, diverging as the external field approaches a value pre-defined by the NV center parameters. We show that the measured sensitivity has excellent agreement with the theoretical predictions. These results show that NV centers may be useful for coupling to torsional nanomechanical oscillators (NMO), to make quantum non-demolition measurements of the number states of the NMO.

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