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Strain engineering of silicon vacancy cantilevers with diamond MEMS SRUJAN MEESALA, YOUNG-IK SOHN, Harvard University, BENJAMIN PINGAULT, University of Cambridge, HAIG ATIKIAN, JEFF HOLZGRAFE, Harvard University, MUSTAFA GUNDOGAN, CAMILLE STAVRAKAS, University of Cambridge, ALP SIPAHIGIL, MICHAEL BUREK, MIAN ZHANG, Harvard University, JOSE PACHECO, JOHN ABRAHAM, EDWARD BIELEJEC, Sandia National Laboratories, MIKHAIL LUKIN, Harvard University, METE ATATURE, University of Cambridge, MARKO LONCAR, Harvard University — We fabricate diamond MEMS cantilevers with SiV centers, and study their optical and spin properties as a function of strain. Under controlled strain fields applied to SiVs by electrostatic actuation of the cantilevers, we characterize the response of the optical transitions. These measurements allow us to infer the SiV strain Hamiltonian. Large strain susceptibilities of the order of 1 PHz/strain indicate the suitability of the SiV for strain-mediated optomechanics. Further, by applying strain, we increase the energy splitting between the ground states from 50 GHz to over 450 GHz. As a result, we modify the thermalization dynamics between the ground state orbitals, and the thermal-phonon limited spin coherence at 4K. Improvement in spin coherence with strain is detected optically as a narrowing of the coherent population trapping (CPT) resonance from the spin transition. We observe measurement-limited spin coherence times of ˜0.17 μs at high strain.

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