Abstract Submitted
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Cooling a Mechanical Resonator with a Nitrogen-Vacancy Center Ensemble Using a Room Temperature Excited State Spin-Strain Interaction[1] EVAN MACQUARRIE, MATT OTTEN, Cornell University, STEPHEN GRAY, Argonne National Laboratory, GREGORY FUCHS, Cornell University — Cooling a mechanical resonator mode to a sub-thermal state has been a long-standing challenge in physics. This pursuit has recently found traction in the field of optomechanics in which a mechanical mode is coupled to an optical cavity. An alternate method is to couple the resonator to a well-controlled two-level system. We propose a protocol to dissipatively cool a room temperature mechanical mode using a nitrogen-vacancy (NV) center spin ensemble. The ensemble is coupled to the resonator through a spin-strain interaction in its orbitally-averaged excited state that is 13.5 ± 0.5 times stronger than the ground state NV center spin-strain coupling. This interaction, combined with a high-density spin ensemble, enables the cooling of a mechanical resonator from room temperature to a fraction of its thermal phonon occupancy.

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