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Towards a Quantum Spin Transducer with Mechanical Resonators ARTHUR SAFIRA, JAN GIESELER, AARON KABCENELL, SHIMON KOLKOWITZ, DAVE PATTERSON, ALEXANDER ZIBROV, Department of Physics, Harvard University, JACK HARRIS, Departments of Physics and Applied Physics, Yale University, MIKHAIL LUKIN, Department of Physics, Harvard University — Nitrogen vacancy centers (NVs) are promising candidates for quantum computation, with room temperature optical spin read-out and initialization, microwave manipulability, and weak coupling to the environment resulting in long spin coherence times. The major outstanding challenge involves engineering coherent interactions between the spin states of spatially separated NV centers. To address this challenge, we are working towards the experimental realization of mechanical spin transducers. We have successfully fabricated high quality factor (Q $>10^5$), doubly-clamped silicon nitride mechanical resonators integrated with magnetic tips, and report on experimental progress towards achieving the coherent coupling of the motion of these resonators with the electronic spin states of individual NV centers under cryogenic conditions. Such a system is expected to provide a scalable platform for mediating effective interactions between isolated spin qubits.

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