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Quantum Control of a Nitrogen-Vacancy Center using Surface Acoustic Waves in the Resolved Sideband Limit DAVID GOLTER, THEIN OO, MAIRA AMEZCUA, HAILIN WANG, University of Oregon — Microelectromechanical systems research is producing increasingly sophisticated tools for nanophononic applications. Such technology is well-suited for achieving chip-based, integrated acoustic control of solid-state quantum systems. We demonstrate such acoustic control in an important solid-state qubit, the diamond nitrogen-vacancy (NV) center. Using an interdigitated transducer to generate a surface acoustic wave (SAW) field in a bulk diamond, we observe phonon-assisted sidebands in the optical excitation spectrum of a single NV center. This exploits the strong strain sensitivity of the NV excited states. The mechanical frequencies far exceed the relevant optical linewidths, reaching the resolved-sideband regime. This enables us to use the SAW field for driving Rabi oscillations on the phonon-assisted optical transition. These results stimulate the further integration of SAW-based technologies with the NV center system.

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