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Coupling a single InAs quantum dot to mechanical motion of a photonic crystal membrane SAMUEL CARTER, ALLAN BRACKER, Naval Research Laboratory, MIJIN KIM, Sotera Defense Solutions, Inc, CHUL SOO KIM, MAXIM ZALALUTDINOV, BRENNAN PURSLEY, Naval Research Laboratory, SOPHIA ECONOMOU, Department of Physics, Virginia Tech, CYPRIAN CZARNOCKI, CAMERON JENNINGS, MICHAEL SCHEIBNER, School of Natural Sciences, University of California, Merced, DANIEL GAMMON, Naval Research Laboratory — Coupling quantum mechanical systems to mechanical motion is attractive for fundamental science, quantum information applications, and sensing. Semiconductor quantum dots (QDs) embedded in suspended photonic crystal structures provide a versatile system for advances in this area. Flexural modes of the suspended membrane as well as localized mechanical modes surrounding optical cavities couple to QDs through strain, with the photonic crystal used to maximize collection of photons from QDs. We have performed high resolution spectroscopy of InAs QDs embedded in photonic crystal structures while optically driving mechanical motion. Using time-correlated photon counting, the strain-induced shift of the QD optical transitions is measured as a function of time. For QDs at the center of the membrane (along the growth direction), the strain is minimum, and the optical transitions shift by only a few μeV. For QDs shifted 30 nm from the center, the strain induces larger shifts of 50μeV. Measurements in a magnetic field are being performed on charged QDs to determine the coupling of mechanical motion to electron and hole spin transitions.

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