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Optomechanics in a dilution refrigerator

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Recent developments in fabrication techniques have allowed reductions in the size of mechanical resonators to the micro- and nano-scale facilitating their use as exquisite sensors of a variety of phenomena. When coupled to optical cavities, these resonators become an attractive means for investigating the limits of quantum mechanics, as well as powerful tools for building hybrid quantum information processing systems. However, in order to reveal interesting quantum mechanical effects and exploit these systems'full potential, it is necessary to reduce the thermal occupation of the resonators to very near their ground state. To that end, we have implemented an optomechanical coupling apparatus on the mixing chamber plate of a commercial dilution refrigerator, featuring full three-dimensional control over the resonator coupling conditions as well as a home-built optical microscope which permits *in situ* imaging and alignment of the resonators at temperatures below 10 mK. This talk will outline our design and present preliminary measurements from this cutting edge system.

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