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Optomechanics in a Millikelvin Environment BRADLEY HAUER, ALLISON MACDONALD, GREG POPOWICH, PAUL KIM, ARON FREDRICK, XAVIER ROJAS, JOHN DAVIS, University of Alberta — As advances in technology continue to improve the quality and reduce the size of nanofabricated devices, we edge closer and closer to the prospect of observing quantized motion of a mesoscopic mechanical resonator. Measurements of such devices, which consist of billions to trillions of atoms, would provide an excellent test of the scales at which quantum mechanics is applicable. However, due to their relatively large effective masses, these devices must be cooled to mK temperatures to reach their quantum ground state. The field of cavity optomechanics, which has already achieved quantum limited measurement sensitivity, provides a promising avenue for performing such measurements. To this end, we have designed a tapered fiber optomechanical coupling apparatus, with full 3D control and real time imaging of the coupling environment, on the base plate of a dilution refrigerator. This experiment is capable of passively cooling devices to temperatures below 10 mK, at which oscillators with resonance frequencies as low as 150 MHz will be cooled to single phonon occupancy. In this talk, I will present preliminary measurements from this cutting edge system.

Bradley Hauer
University of Alberta

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