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Room Temperature Experiments with a Macroscopic Sapphire Mechanical Oscillator JEREMY BOURHILL, EUGENE IVANOV, MICAHEL TOBAR, UWA — We present initial results from a number of experiments conducted on a 0.53 kg sapphire "dumbbell" crystal. Mechanical motion of the crystal structure alters the dimensions of the crystal, and the induced strain changes the permittivity. These two effects frequency modulate resonant microwave whispering gallery modes, simultaneously excited within the crystal. A novel microwave readout system is described allowing extremely low noise measurements of this frequency modulation with a phase noise floor of -160 dBc/Hz at 100 kHz, near our modes of interest. Fine-tuning of the crystal's suspension have allowed for the optimisation of mechanical Q-factors in preparation for cryogenic experiments, with a value of 8 x 10^7 achieved so far. Finally, results are presented that demonstrate the excitation of mechanical modes via radiation pressure force. These are all important steps towards the overall goal of the experiment; to cool a macroscopic device to the quantum ground state.

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