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Cryogenic optomechanics with a 261kHz mechanical oscillator DONGHUN LEE, ANDREW JAYICH, Yale University, JACK SANKEY, McGill University, CHEN YANG, LILY CHILDRESS, MITCHELL UNDERWOOD, KJETIL BORKJE, STEVE GIRVIN, JACK HARRIS, Yale University — Mechanical motion can interact with light via radiation pressure force. With recent experimental advances over the last few years, such optomechanical coupling has been used to reach quantum ground state of mechanical oscillators, which opens interesting new regime of observing quantum mechanics in macroscopic objects. The optomechanical devices used in this talk consist of a dielectric SiN membrane located inside a high finesse optical cavity. Combining cryogenic cooling in He3 refrigerator and resolved sideband laser cooling enables us to cool the membrane's mechanical mode (whose mechanical frequency is 261kHz) to less than 60 phonons. We will describe some technical challenges in our experiments such as the role of classical phase noise of the cooling laser at the mechanical frequency and our efforts to significantly reduce it via a filter cavity.

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