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Ultrathin circular membranes with high quality factors VIVEKANANDA ADIGA, School of Applied and Engineering Physics, Cornell University, ROB ILIC, Cornell Nanofabrication Facility, ROB BARTON, School of Applied and Engineering Physics, Cornell University, JEEVAK PARPIA, Physics Department, Cornell University, HAROLD CRAIGHEAD, School of Applied and Engineering Physics, Cornell University — We have fabricated large ultrathin circular drum resonators from monolayer graphene (up to 90  $\mu$ m in diameter) and silicon nitride ( $\sim 15$  nm, up to 1mm in diameter). Resonant frequency, quality factor (Q) of different modes of these self tensioned graphene drums and high tensile stress  $(\sim 1 \text{GPa})$  silicon nitride were measured using optical interferometric detection technique. We measured extremely high quality factors (up to 5,000 for graphene and up to 4,000,000 for ultrathin silicon nitride membranes) at room temperature. High quality factors observed in these resonators indicate dissipation mechanisms which differ from the conventional high surface to volume ratio resonators that show very low quality factors. The measured mechanical dissipation  $(Q^{-1})$  shows a strong size and modal dependence, possibly indicating the influence of clamping losses in these tensioned membranes. These findings pave the way for identifying optimum size and modes for achieving high Q oscillators for applications in mass sensing and optomechanical coupling experiments which are underway.

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