

Abstract Submitted
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Magnetic resonance force detection using a membrane resonator NICOLAS SCOZZARO, WILLIAM RUCHOTZKE, AMANDA BELDING, JEREMY CARDELLINO, ERICK BLOMBERG, BRENDAN MCCULLIAN, VIDYA BHALLAMUDI, DENIS PELEKHOV, P. CHRIS HAMMEL, Ohio State University - Columbus — Silicon nitride (Si_3N_4) membranes are commercially-available, versatile structures that have a variety of applications. Although most commonly used as the support structure for transmission electron microscopy (TEM) studies, membranes are also ultrasensitive high-frequency mechanical oscillators. The sensitivity stems from the high quality factor $Q \sim 10^6$, which has led to applications in sensitive quantum optomechanical experiments. The high sensitivity also opens the door to ultrasensitive force detection applications. We report force detection of electron spin magnetic resonance at 300 K using a Si_3N_4 membrane with a force sensitivity of $4 \text{ fN}/\sqrt{\text{Hz}}$, and a potential low temperature sensitivity of $25 \text{ aN}/\sqrt{\text{Hz}}$. Given membranes' sensitivity, robust construction, large surface area and low cost, SiN membranes can potentially serve as the central component of a compact room-temperature ESR and NMR instrument that has superior spatial resolution to conventional NMR.

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