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Impact of Atomic Gap Size on Sensitivity and Backaction of APC Displacement Detectors N.E. FLOWERS-JACOBS, K.W. LEHNERT, JILA, NIST and the University of Colorado, and the Department of Physics, University of Colorado, Boulder, Colorado 80309-0440, USA — Recently our group created a mesoscopic displacement detector formed by coupling an atomic point contact (APC) to a nanomechanical beam and demonstrated a displacement imprecision limited by the fundamental shot-noise in the number of electrons that tunnel across the APC [1]. We continue this work by using a cryogenic apparatus that flexes the device substrate to mechanically adjust the size of the APC atomic gap *in situ*. The resulting changes in the APC displacement detector's intrinsic noise properties are measured by observing the 1 K random thermal motion of the nanomechanical beam at resonance frequencies up to 200 MHz. The goal of this work is to explore the effect of atomic gap size and shape on displacement sensitivity, understand the origin of the observed measurement backaction, and measure the recoil force of tunneling electrons.

[1] N. E. Flowers-Jacobs, D. R. Schmidt, and K. W. Lehnert, *Phys. Rev. Lett.* **98**, 096804 (2007)

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