Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Low-frequency noise in gallium nitride nanowire mechanical resonators JASON GRAY, University of Colorado, KRIS BERTNESS, NORMAN SANFORD, National Institute of Standards and Technology, CHARLES ROGERS, University of Colorado — We report on the low-frequency 1/f (flicker) parameter noise displayed by the resonance frequency and resistance of doubly clamped c-axis gallium nitride nanowire (NW) mechanical resonators. The resonators are electrostatically driven and their mechanical response is electronically detected via NW piezoresistance. With an applied dc voltage bias, an NW driven near its mechanical resonance generates a dc and Lorentzian rf current that both display 1/f noise. The rf current noise is proportional to the square of the derivative of the Lorentzian lineshape with a magnitude highly dependent on NW dc bias voltage conditions, consistent with noise in the NW's resistance leading to temperature noise from local Joule heating, which in turn generates resonance frequency noise. An example device with a 27.8 MHz resonance frequency and 220 kΩ resistance experiences an approximate resonance frequency shift of -5.8 Hz/nW. In terms of NW resistance change, this corresponds with shifts of 0.1 Hz/Ω and 2.6 Hz/Ω at 1 V bias and 4 V bias, respectively, with an average resistance fluctuation of 1 kΩ in a 1-second bandwidth.

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Date submitted: 10 Nov 2011 Electronic form version 1.4