Noise Temperature and Thermodynamic Temperature of a Sample-on-Cantilever System Below 1K ANIA BLESZYNSKI, WILL SHANKS, JACK HARRIS, Department of Physics, Yale University — Micromechanical systems such as cantilevers are frequently used to detect ultra-small forces and displacements. In a sample-on-cantilever geometry, operation at low temperature requires cooling the thermodynamic temperature of the sample $T_S$ and the noise temperature of the cantilever $T_N$. This can be challenging because for high-Q cantilevers, these temperatures are only weakly coupled. In addition, for insulating cantilevers monitored by a reflected laser beam, these temperatures may also be weakly coupled to the refrigerator temperature. We have made quantitative measurements of $T_N$ and $T_S$ for a sample-on-cantilever set-up as a function of incident laser power and refrigerator temperature below 1 Kelvin. We infer $T_S$ from measurements of the critical magnetic field of a superconducting sample mounted on the cantilever. $T_N$ is inferred from the cantilever’s Brownian motion. We find that for this system both $T_S$ and $T_N$ remain quite close to the refrigerator temperature.

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Date submitted: 21 Nov 2006