



Development of tensioned ion-implanted silicon absorber wires for large-area multimode bolometers

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The Primordial Inflation Explorer (PIXIE) is an Explorer-class mission concept designed to measure the B-mode polarization of the cosmic microwave background (CMB) [1]. We are developing the polarization-sensitive bolometers for PIXIE, which are based on silicon thermistors. In the following we report on the design and implementation of a scheme to greatly raise the frequencies of the internal vibrational modes of a large-area, low-mass optical absorber structure consisting of a grid of micromachined, ion-implanted silicon wires. This is done by pre-tensioning the silicon wires by depositing a highly-tensile dielectric film on the absorbers outside of the active optical area. With higher mechanical resonance frequencies, our silicon thermistor-based bolometers for PIXIE are expected to be robust in the vibrational and acoustic environment at launch of the space mission. More generally, the pre-tensioning technique could be used to reduce microphonic sensitivity in other types of low temperature detectors. In this work we present details on the design, fabrication, and performance of these tensioning elements.

[1] A. Kogut, et al., "The Primordial Inflation Explorer (PIXIE): a nulling polarimeter for cosmic microwave background observations," *Journal of Cosmology and Astroparticle Physics*, vol. 2011, issue 7, paper number 25.