Detection of Zeptojoule Microwave Pulses Using Electrothermal Feedback in Proximity-induced Josephson Junctions

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***Abstract* – We experimentally investigate and utilize electrothermal feedback in a microwave nanobolometer based on a normal-metal (Au_xPd_{1-x}) nanowire with proximity-induced superconductivity. The feedback couples the temperature and the electrical degrees of freedom in the nanowire, which both absorbs the incoming microwave radiation, and transduces the temperature change into a radio-frequency electrical signal. We tune the feedback *in situ* and access both positive and negative feedback regimes with rich nonlinear dynamics. In particular, strong positive feedback leads to the emergence of two metastable electron temperature states in the millikelvin range. We use these states for efficient threshold detection of coherent 8.4 GHz microwave pulses containing approximately 200 photons on average, corresponding to 1.1×10−21 J ≈ 7.0 meV of energy.**

***Keywords (Index Terms)* – Microwave, pulse, zeptojoule, detection, electrothermal feedback, Au_xPd_{1-x} nanowire, proximity superconductivity.**

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