Optimization of Microcalorimeters without Linearity Constraints

Main author:

MOSELEY Harvey

Co-authors:

Cabrera Blas, Dept. of Physics, Stanford University
Fixsen Dale, NASA/GSFC and University of Maryland
Irwin Kent, Dept. of Physics, Stanford University
Moseley Harvey, NASA/GSFC

The optimization of microcalorimeters in the linear regime is typically done by choosing a combination of heat capacity and temperature coefficient such that the maximum energy events approach saturation, providing a large linear range of operation. Fixsen et al. (2014) have developed an optimal filtering process that can be extended into the fully nonlinear range, even with nonstationary noise, that can achieve resolution in the nonlinear regime that is very close to that in the linear regime, implying that the allowable heat capacity of microcalorimeters may be much lower than currently used, and that the achievable energy resolution may be significantly higher. In this paper we search for an optimal detector design given constraints of maximum event energy, event energy spectral slope, allowable dead time, and sensitivity to operational parameters. Such an optimized detector may be a path to significantly higher dynamic range for spectrometers and much improved low energy spectral resolution.