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Precision characterization of thermal circuits and noise of TES microcalorimeters

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Understanding "excess"noise in transition edge sensor microcalorimeters requires accurate models of their thermal circuit to correctly predict intrinsic noise components. Complex admittance measurements are routinely used to extract the parameters of the thermal model but can be ambiguous for complex thermal circuits. When measuring complex admittance, proper accounting for stray impedance is crucial to attaining the correct high-frequency limit which yields the current sensitivity beta=I/R dR/dI. One recent advance in this area is the precise determination of the value of the bias shunt resistance via the measurement of Shapiro steps. Additional constraints on the thermal model can be obtained from including in the analysis the response to thermal input into the absorber, i.e. the response to X-ray pulses.

Here we apply the aforementioned methods to X-ray microcalorimeters with complex absorber thermal systems in a well-characterized test setup. In addition, we demonstrate how the complex admittance measurement can be sped up by measuring the transfer function at multiple frequencies in parallel via a software lock-in technique.

Less than 5 years of experience since completion of Ph.D

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