Mapping Transition-edge Sensor Temperature Sensitivity and Current Sensitivity Surface as a Function of Current, Magnetic Field and Temperature with IV curve and Complex Impedance Measurement

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Motivation

1. To resolve the spectra of the astronomical diffuse X-ray background in the 0.1-0.5 keV energy range, we need large area pixels (~1mm²) with excellent energy resolution (1-2 eV).
2. For TES pixels with large absorbers that have a relatively high heat capacity, high α and low β are needed to achieve the required energy resolution.
3. Most work in the field has found high α to be correlated with high β and also with excess noise. The cause of this correlation remains to be understood.

References

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Summary
1. We characterized two TES devices and compared them. The TES with no finger or bank structures is more sensitive to the magnetic field than the three finger TES, while the period of the fringes on the Bi curve is about the same for both devices.
2. The IV curves of both devices show Shapiro steps when a high frequency external field is applied. More Shapiro steps are visible on the zero finger TES IV curve than the three finger TES.
3. The simple thermal model with only one time constant can’t fit the complex admittance very well. The fitting results give smaller α compared with IV curve. The two block thermal model yields a better fit.