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Optimizing SuperCDMS phonon energy sensitivity by studying quasiparticle transport in Al films JEFFREY YEN, BENJAMIN SHANK, BLAS CABRERA, ROBERT MOFFATT, PETER REDL, Stanford University, PAUL BRINK, ASTRID TOMADA, MATT CHERRY, SLAC Notional Accelerator Laboratory, BETTY YOUNG, TEDDY TORTORICI, JOHN MARK KREIKEBAUM, Santa Clara University, CDMS COLLABORATION — In order to further improve the phonon energy sensitivity of Cryogenic Dark Matter Search (CDMS) detectors, we studied quasiparticle transport at $\sim$ 40 mK in superconducting Al films similar in geometry to those used for CDMS detectors. Test structures of Al were deposited and photolithographically patterned on Si wafers using the same production-line equipment used to fabricate kg-scale CDMS detectors. Three Al film lengths and two film thicknesses were used in this study. In the test experiments described here, an 55Fe source was used to excite a NaCl reflector, producing 2.6 keV x-rays that hit our test devices after passing through a collimator. The impinging x-rays broke Cooper pairs in the Al films, producing quasiparticles that propagated into W transition edge sensors (TESs) coupled to the ends of the Al films. In this talk, we will give the motivation behind these studies, describe our experimental setup, and compare our data to results obtained using signal processing models constructed from basic physical parameters. We show that a non-linear, non-stationary optimal filter applied to the data allows us to precisely measure quasiparticle diffusion and other aspects of energy transport in our thin-film Al-W test devices. These results are being used to further optimize next-generation CDMS detectors.

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