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SQUID Noise Measurements for CDMS Detectors

The Cryogenic Dark Matter Search is the second iteration of SuperCDMS dark matter experiments with an increase in sensitivity to low mass dark matter particles. The experiment uses germanium and silicon crystals which are capable of detecting both the charges and phonon signals produced from dark matter interactions. Detectors are housed in towers which are then housed in a cryogenics system able to cool down to 15 mK. The experiment will be installed in an underground lab in Sudbury, Ontario in order to shield from cosmic rays and background radiation. SQUIDs are an acronym for superconducting quantum interference devices that are capable of detecting extremely small magnetic fields. A typical dark matter nuclear recoil interaction can be detected by a TES (transition edge sensor). SQUIDs are then used to read out and amplify the signals generated by the TES. It is essential that these SQUIDS add negligible noise to the intrinsic noise of the TES to be able to distinguish the internal circuit noise from a true dark matter interaction signal. The noise was measured while varying several parameters. Both an Agilent and an SRS785 spectrum analyzer were used. Furthermore, an amplifier which amplified the signal 10x was tested. The Agilent machine produced more noticeably greater noise in the region from 100-1000 Hz, whereas the SRS785 did not. Next, the amplifier was tested and the signal generated was analyzed in comparison to the original signal. The amplifier did not produce any noticeable additional noise over the intrinsic noise of the SQUID. Further work includes testing to see if detectors with higher voltage sources can also be used with negligible noise.