

## Flux-Coupled Direct Feedback in a SQUID Amplifier

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**Abstract** - The Cryogenic Dark Matter Search (CDMS) employs dc superconducting quantum interference device (SQUID) series array amplifiers (SSAAs) in its phonon readout system. These amplifiers are in a transresistance topology utilizing feedback from room-temperature electronics. The input coil of each SSAA is in series with a phonon sensor composed of many parallel transition edge sensors (TES's). The SSAA consists of 100 individual SQUIDs, each surrounded by planar input and feedback coils with an electrically isolated flux-focusing washer, which increases the inductive coupling between the SQUID and each coil. A room-temperature gain stage completes the feedback loop between the SSAA output voltage and the feedback coil current. We report on a significant mutual inductance that exists directly between the feedback and input coils, on its impact on the feedback network of the amplifier, and on the resulting transfer function. The consequent effects include a partial nulling of the input coil's self-inductance, as well as resonant peaking in the closed-loop response that depends on the impedance of the input coil circuit.

**Index Terms** - Feedback amplifiers, Particle detectors, Squids, TES.

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