

Improved DC SQUIDS

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1. ABSTRACT

DC SQUIDS are the most sensitive magnetometers built to date, and are used as the read-out/amplifier in several important fundamental physics experiments, including dark matter detection fifth force tests and EDM measurements. To date most improvements in SQUIDS have been driven by biomedical & biomagnetism applications; however at this point the sensitivity has reached what is required for all clinical applications, and nearly all research applications. Searches for low-mass dark matter coupling to photons are currently limited by the noise of the SQUID and under realistic assumptions, SQUID noise will also be the leading noise source in certain EDM searches, probes for dark-matter axion-fermion interactions and fifth-forces generated by axion-exchange. For these reasons, investing in improvements to DC-SQUIDS will benefit particle physics. There are several avenues available to reduce SQUID noise: develop fab techniques for lower-capacitance Josephson junctions, refine two-stage SQUIDS and optimize the inductance matching of the SQUID and pickup coils. All of these strategies will require specialized knowledge, and should be done in collaboration with the PTB-Berlin biomagnetism groups that have pushed SQUID technology forward in recent years.