

Instrumentation concepts for Neganov-Luke assisted mK-temperature Germanium detectors in dark matter search

In direct searches for dark matter, the signature is a recoiling nucleus being hit by a massive dark matter particle, a so-called WIMP. A viable technology to search for such recoil signatures are detector arrays of Ge mono-crystals operated at a few mK temperature and equipped with electrodes and thermal sensors. Applying a small (few V/cm) external field, a simultaneous measurement of ionization and heat signals allows efficient discrimination of nuclear (signal) against electron recoils (background). Applying a larger bias leads to a so-called Neganov-Luke assisted amplification of the heat signal, lowering the effective threshold and thus opening a search for low mass WIMPs.

The electronics and DAQ system for such a cryogenic low-threshold setup will be presented and discussed, with special emphasis on the realisation in the EDELWEISS experiment as well as in currently ongoing R&D projects.

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