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DANAE - a new experiment for direct dark matter detection with DEPFET silicon detectors

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The sub-GeV mass region of WIMPs as a dark matter candidate is foreseeably to be explored intensively in the next generation of direct detection experiments.
Essig and others [1] recently discussed the feasibility of detecting the energy deposit from the dark-matter electron recoil using low-noise semiconductor detectors as the active target. With a readout noise level below 1 electron RMS, the sensitivity allows us to test several theoretical models that account for dark matters with sub-GeV mass.
One of the two silicon-based archetectures that are capable of reaching such noise level, is the DEPFET (Deeply-depleted P-channel Field Effect Transistor) with Repetitive Non Destructive Readout (RNDR). The prototype of this detector has been developed by the Semiconductor Laboratory of the Max Planck Society. and the readout of a single pixel has successfully reached the expected sub-electron noise level as reported in [2].
In this presentation, we will first introduce the working concept of the DEPFET-RNDR based on the recent publication [2]. Then we present a new project DANAE - Direct dArk matter detection using DEPFET with reptitive Non-destructive readout Application Experiment, that plans to apply this type of detector for the direct detection of dark-matter electron recoil.
We started in late 2017 the R&D for the experiment, with the following two objectives in the near future. The first one is to build a setup including the readout for a 64 pixel × 64 pixel matrix with 75 μm × 75 μm pixel size, and to reach the noise level achieved in the single pixel measurement. The second one is to measure the temperature dependence of the leakage current, which is crucial to determine the operating temperature of the detector and to further optimize the number of repetitive readout cycles to reach an optimal noise level. Ongoing efforts to reach the above goals and future perspectives will be discussed.

Authors: Dr SHI, HEXI (HEPHY OeAW); Dr BAEHR, Alessandro (HLL MPG); Dr KLUCK, Holger (HEPHY); Dr NINKOVIC, Jelena (HLL MPG); Prof. SCHIECK, Jochen (HEPHY OeAW); Dr TREIS, Johannes (HLL MPG)

Presenters: Dr SHI, HEXI (HEPHY OeAW); Dr SHI, HEXI

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