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DANAE –A direct search for light Dark Matter with DEPFET-RNDR detectors

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In recent years, the direct search for light dark matter (DM) particles at the sub-GeV/c² mass scale gained increasing interest due to several benefits of the theory –concerning the explanation of astrophysical observations –as well as due to the experimental exclusion of heavier candidates. One promising option for a direct detection is the scattering of light DM particles with electrons. Highly sensitive silicon semiconductor devices with deep sub-electron noise provide the opportunity to extend the detection thresholds down to a few MeV/c².

One technology, which is capable to achieve the required distinction between single signal electrons are Depleted P-channel Field Effect Transistor (DePFET) with Repetitive Non-Destructive Readout (RNDR). Initially, DEPFET detectors were developed for X-ray spectroscopy and were modified to enable a variety of different applications. The low noise performance of RDNR-DeFPETs below 0.2 e-ENC at readout times in the range of ms/pixel has already been demonstrated with single pixel devices [1]. We will present preliminary results from a 64x64 pixel matrix of RNDR-DePFETs. The DANAE project aims to apply DePFET-RNDR matrices for the direct DM searches and detailed instrumental studies are necessary before the background can be investigated and scientific measurements become feasible. In this contribution we will introduce the DANAE project and present the RNDR-DEPFET technique before discussing the status, preliminary results, and prospects of the project.

[1] A. Bähr, H. Kluck, J. Ninkovic, J. Schieck and J. Treis, Eur. Phys. J. C77 (2017) 905, arXiv:1706.08666

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