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Operating the GridPix detector in dark matter search experiments

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The DARWIN design study aims to use liquid argon and liquid xenon targets to look for nuclear recoils due to Weakly Interacting Massive Particles. To measure the recoil energy in dual-phase noble gas time projection chambers the combination of scintillation and ionisation detection is used to discriminate nuclear from electron recoils. Current experiments use an array of photomultiplier tubes to detect the primary scintillation and the ionisation electrons via secondary scintillation in the gas phase.
Within the research framework for DARWIN, one candidate for an alternative charge readout is GridPix, a micro-pattern gaseous detector composed of a Micromegas-like amplification grid over the Timepix 65k pixel readout chip. It can achieve a single-electron detection efficiency of up to 98 % and has thus great potential to identify the ionisation electrons in dark matter search experiments.
The main challenges for this application are low outgassing, thermal robustness, and operation in pure (thus quencher-free) noble gas.
To investigate its applicability we operated a GridPix detector in a dual-phase argon cryostat. We proved GridPix's perfomance in pure argon. The gas amplification was confirmed in pure argon in the broad temperature range from 300 K down to 87 K. Moreover, we will present results of studies in pure xenon gas at room temperature.

for the collaboration

DARWIN

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