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Two-phase Cryogenic Avalanche Detector with electroluminescence gap and THGEM/GAPD-matrix multiplier

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Two-phase Cryogenic Avalanche Detectors (CRADs) with THGEM multipliers have become an emerging potential technique for rare-event experiments. In this work the current status of the two-phase CRAD prototype in Ar, with electroluminescence (EL) gap and combined THGEM/GAPD-matrix multiplier, is described. The low threshold and high energy resolution of the detector is provided by the EL gap, optically read out in the VUV using compact cryogenic PMTs. The high spatial resolution of the detector is provided by the double-THGEM charge multiplier combined with a 5x5 matrix of Geiger-mode APDs (GAPDs), optically recording THGEM-hole avalanches in the Near Infrared (NIR). The proportional electroluminescence in gaseous Ar has for the first time been systematically studied at cryogenic temperatures in the two-phase mode. We also present the first results on nuclear recoil detection in liquid Ar, using the two-phase CRAD and DD neutron generator, relevant in the field of calibration of rare-event detectors for dark matter search and coherent neutrino-nucleus scattering experiments.

Primary author: Dr SOKOLOV, Andrey (Novosibirsk State University, Budker Institute of Nuclear Physics)

Co-authors: Prof. BONDAR, Alexander (Budker Institute Nuclear Physics); Prof. DOLGOV, Alexander (FE); Prof. BUZULUTSKOV, Alexey (Novosibirsk state university, Budker INP); Mrs SHEMYAKINA, Ekaterina (Novosibirsk state university, Budker INP); Mr SHEKHTMAN, Lev (Budker INP); Mr NOSOV, Valery (Novosibirsk state university, Budker INP)

Presenter: Dr SOKOLOV, Andrey (Novosibirsk State University, Budker Institute of Nuclear Physics)

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