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Two-phase avalanche detectors based on gas electron multipliers

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The performances of two-phase Ar and Xe avalanche detectors were studied, aiming at their potential application in low-background experiments, such as those of coherent neutrino-nucleus scattering and dark matter search. The two-phase avalanche detector had a liquid Ar or Xe layer and a triple-GEM multiplier operated in the saturated vapour above the liquid phase. The successful operation of the two-phase Ar avalanche detector in a single electron counting mode, in the gain range of 6000-40000, has been demonstrated. The gain and stability characteristics were measured. The detector was shown to be sensitive to weak signals produced by nuclear recoils from neutron scattering and by 60 keV gamma-rays. The detection of the scintillation signal produced in the liquid by beta-particles and gamma-rays is provided in the two-phase Ar avalanche detector, the first GEM acting as a photocathode.

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