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Development of solid xenon detectors for low-background experiments

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In modern astroparticle physics, noble gases are often chosen as detector material for a wide range of different experiments. Noble gases can provide a very long electron drift distance which is required for large-scale low-background experiments such as the search for dark matter or for the neutrinoless double beta decay.

Due to the higher density, xenon is often used in the liquid instead of gaseous state, which allows a larger detection mass at constant volume. However, solid xenon detectors could provide additional advantages over liquid xenon setups.

We present the results of recent experiments on large xenon crystals grown from the liquid phase. We successfully measured the scintillation light from ionizing radiation in the crystal and compared it to Monte Carlo simulations. Also, we studied the drift of electrons over several centimeters. The results suggest a higher drift velocity and a better collection efficiency of secondary electrons than in the case of liquid xenon.

Our work is the basis of the future development of new kind of TPC using solid xenon in combination with the Timepix detector. It would benefit from the excellent electron drift characteristics of xenon. A new detector design involving both solid xenon and the Timepix detector will be presented.

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