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Abstract : We have investigated the application of liquid xenon in high resolution, low background and efficient gamma- ray detectors for the observation in space of weak sources emitting in the 0.1 - 10 MeV energy region. The basic requirement of ultra-high purity liquid xenon, necessary for the successful operation of these detectors has been satisfied with the development of an efficient and reliable purification system, capable of reducing and maintaining the concentration of electronegative impurities below one part in 109. The charge and energy resolution response of a liquid xenon (and liquid argon) ionization chamber has been systematically measured as a function of electric field strength, using various radioactive sources. Our results of 4.5% FWHM and 2.6% FWHM at 1 MeV in liquid xenon and liquid argon, respectively are the best reported in the literature. Their deviation from theoretical estimates based on Fano factor statistics has been interpreted as due to recombination straggling on low energy delta-electrons produced along the primary ionizing particle. The effect of photosensitive dopants in the liquid has also been measured. Improved charge collection and energy resolution is observed for the case of alpha particles. In view of its application for event triggering in an imaging ionization chamber, we have measured the yield of the primary scintillation light abundantly emitted in liquid Xenon, using both electrons and alpha particles. The dependence of the event will provide an ideal tool for background rejection.

Descriptors : *OPTICS, ALPHA PARTICLES, ARGON, BACKGROUND, COLLECTION, CONCENTRATION(COMPOSITION), DETECTORS, EFFICIENCY, ELECTRIC FIELDS, ELECTRONS, EMISSION, ENERGY, ESTIMATES, FIELD INTENSITY, HIGH RESOLUTION, IMAGES, IMPURITIES, IONIZATION, IONIZATION CHAMBERS, LIGHT, LIQUIDS, LOW STRENGTH, PURIFICATION, RADIOACTIVE MATERIALS, REJECTION, RELIABILITY, REQUIREMENTS, RESOLUTION, RESPONSE, SCINTILLATION, SOURCES, STATISTICS, XENON.

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