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Development of a large gaseous xenon detector for neutrino-less double beta decay with the Enriched Xenon Observatory

The EXO collaboration is searching for neutrinoless double beta decay using isotopically enriched Xenon (136Xe). Currently operating a 200 kg liquid xenon experiment, EXO is also conducting R&D toward a high pressure xenon gas detector using enriched 136Xe at up to 10 bar. This solution might offer better energy resolution than its liquid xenon counterpart and allow discrimination between single and double electrons, thus suppressing detector background. The high pressure xenon detector would detect primary scintillation light and ionization electrons, a technique known to yield good energy resolution. Achieving superior energy resolution also requires very low concentration of electronegative impurities in the gas and, in turn, reliable and robust purification techniques. Detection of doubly charged Ba++ ions, not possible in liquid xenon, might be possible in the gaseous phase. Ba++ ions could be transported by high electric fields and through a nozzle into a lower pressure detection region where they could be identified via optical spectroscopy in order to discriminate barium-producing signal events from radioactive background. The status of gaseous xenon detector development, design details and construction schedule of a first prototype detector, including its gas handling and purification systems will be presented, along with the illustration of the Ba tagging strategies currently being pursued.

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