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Krypton Removal via Gas Chromatography for the LZ Experiment

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Trace radioactive noble elements are a potential source of electron recoil backgrounds in liquid xenon-based detectors. Commercially available research-grade xenon contains krypton at a concentration of up to 10-7 g/g as a byproduct of its extraction from the atmosphere. About 1 part in 1012 of this residual krypton is krypton-85, a beta emitter with an endpoint energy of 687 keV and a half-life of 10.8 years. The science goals of the LZ dark matter experiment require that the ten tonnes of detector xenon contain a total krypton concentration of no more than 3×10-13 g/g. To achieve this, a gas charcoal chromatography system was built and operated at SLAC to remove krypton from the xenon prior to deployment in the detector. Using two charcoal columns in parallel to continuously process xenon, the system was automated to operate nearly 24 hours per day, and achieved a final purity of 1.1×10-13 g/g krypton in the full ten tonnes of xenon. In this talk, I will give an overview of the design and operation of the LZ krypton removal system at SLAC, and discuss some of the unique challenges encountered and lessons learned during the purification campaign.

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