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37Ar Calibration of a Two-Phase Xenon Detector

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The Particle Identification in Xenon at Yale (PIXeY) experiment is a three kg active-mass, two-phase (liquid and gas) xenon detector. Experiments aiming to directly detect dark matter often employ two-phase xenon detectors. PIXeY has been designed and built to investigate and optimize properties of this class of detectors. To this end, the drift field (applied between the cathode and gate grids causes charged particles to drift towards the xenon liquid surface) and the extraction field (applied between the gate and anode grids extracts particles from the liquid surface) can be easily modified. A candidate particle for dark matter is an axion-like pseudoscalar, which interacts with xenon via electron recoils at low energy. Additionally, the neutrino magnetic moment can be searched by examining the rates of neutrino-electron scattering at low energy. Therefore, understanding liquid xenon's response in this low-energy regime and how that response varies with drift field is vitally important. 37Ar is an ideal source for calibrating our detector at these low energies, because it decays via electron capture (EC) and releases x-rays at two energies: 2.8 keV due to EC from the K-shell and 0.27 keV due to EC from the L-shell. This talk will explain the motivation, creation, deployment, and results of the 37Ar source in PIXeY.

Primary author: Ms BOULTON, Elizabeth (Yale University)

Co-authors: Dr EDWARDS, Blair (Yale University); Mr TENNYSON, Brian (Yale University); Dr WAHL, Christopher (Yale University); Dr MCKINSEY, Daniel (University of California - Berkeley); Dr BERNARD, Ethan (University of California - Berkeley); Dr HORN, Markus (Sanford Underground Research Facility); Dr GAI, Moshe (University of Connecticut); Dr DESTEFENO, Nicholas (University of Connecticut); Dr LARSEN, Nicole (University of Chicago); Dr HERTEL, Scott (University of California - Berkeley)

Presenter: Ms BOULTON, Elizabeth (Yale University)

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