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Development of an Atom Counting System to Measure Ultralow ^{85}Kr Contamination in Liquid Xenon Dark Matter Detectors TANYA ZELEVINSKY, CLAIRE ALLRED, LUKE GOETZKE, ELENA APRILE, Columbia University — Weakly Interacting Massive Particles (WIMPs) may constitute the dark matter that makes up 25% of our universe. Various WIMP detection methods are currently pursued; the XENON experiment expects to detect low energy nuclear recoils in liquid xenon due to dark matter interactions. An experiment with a ton scale Xe target is projected to be sensitive to a spin-independent WIMP-nucleon collision cross section of 10^{-47} cm^2. To achieve this high sensitivity, background events from inherent radioactivity of the target must be suppressed, particularly the beta-decay of the ^{85}Kr rare isotope. The tolerable contamination by all Kr isotopes is below a part per trillion. To quantitatively measure the Kr contamination of Xe, we are constructing a single atom counting apparatus that relies on laser cooling and trapping of metastable Kr. The detection of ultralow atom numbers is made possible by the excellent spatial selectivity of the magneto-optical trap and efficient fluorescence collection on the strong cycling transition of Kr.

Tanya Zelevinsky
Columbia University

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