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Detection of the barium daughter in ^{136}Xe $\rightarrow^{136}$Ba + 2e$^-$ by *in situ* single-molecule fluorescence imaging DAVID NYGREN, University of Texas at Arlington — To proceed toward effective "discovery class" ton-scale detectors in the search for neutrino-less double beta decay, a robust technique for rejection of all radioactivity-induced backgrounds is urgently needed. An efficient technique for detection of the barium daughter in the decay ^{136}Xe $\rightarrow^{136}$Ba + 2e$^-$ would provide a long-sought pathway toward this goal. Single-molecule fluorescent imaging appears to offer a new way to detect the barium daughter atom, which emerges naturally in an ionized state in pure xenon. A doubly charged barium ion can initiate a chelation process with a non-fluorescent precursor molecule, leading to a highly fluorescent complex. Repeated photo-excitation of the complex can reveal both presence and location of a single ionized atom with high precision and selectivity. Detection within the active volume of a xenon gas Time Projection Chamber operating at high pressure would be automatic, and with a capability for redundant confirmation.

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