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Neutrino-less double beta decay search with Xe-136 and Ba ion tagging R&D

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Neutrino oscillation experiments have shown that neutrinos have finite masses. The study of neutrino-less double beta decay may bring insight on the neutrino mass generation and determine the effective neutrino mass. The next generation neutrino-less double beta decay experiments, with a very large active mass and ultra low background, like the proposed nEXO, will have a sensitivity to the half-life on the order of 10e28 years. These detectors face tremendous challenges for reducing the background due to the trace radioactivity. Standard background reduction techniques have reached a limit and so a novel one must be developed. Double beta decay of Xe-136 produces a Ba-136 ion, the only element for which there is experimentally demonstrated single ion detection and identification capability using resonant light scattering. Tagging the Ba ion can lead to total elimination of the background from radioactive impurities or of cosmic origin. However, applying Ba ion tagging to a massive liquid Xe detector is a challenge. In this talk I will present the field of neutrino-less double beta decay search focusing particularly on Xe-136 as well as the Ba ion tagging efforts within the EXO collaboration.

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