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NEXT: first neutrino-less double beta decay searches in gaseous Xe and roadmap towards a ton-scale detector

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The NEXT experiment aims at the sensitive search of the neutrinoless double beta decay ($\beta\beta0\nu$) in ^{136}Xe, using high-pressure gas electroluminescent time projection chambers. The NEXT-White detector, a radiopure demonstrator operated in the Laboratorio Subterraneo de Canfranc (LSC), has been used to implement the first searches with this technology. The analysis considers the combination of 271.6 days of ^{136}Xe-enriched data and 208.9 days of ^{136}Xe-depleted data. Limits to the half-life of the $\beta\beta0\nu$ decay are obtained with both a background-model-dependent approach and a novel direct background-subtraction technique. With a fiducial mass of only 3.50±0.01 kg of ^{136}Xe, 90\% C.L. lower limits are found in the $T^{0\nu}_{1/2} > 5.5\times10^{23} - 1.3\times10^{24}$ yr range, depending on the method. The presented techniques will be fully exploited with larger NEXT detectors. The NEXT-100 detector, holding up to ∼100 kg of Xe, is currently being installed in the LSC. With a background index below 5×10^{-4} counts/keV/kg/year, this detector has an expected sensitivity of 6×10^{25} yr after 3 years of data taking. NEXT-100 will also set the grounds for the construction of a ton-scale detector, NEXT-HD, boosting the sensitivity above 10^{27} yr. An extensive R&D line is being conducted to equip NEXT-HD with Ba-tagging capabilities, so a truly background-free experiment can be eventually implemented.

Submitted on behalf of a Collaboration?

Yes

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