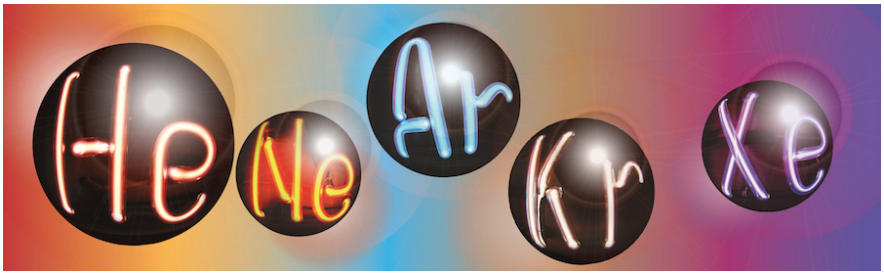

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NEXT: Searching for the ββ0ν decay with High-Pressure Xenon Electroluminescent TPCs

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The NEXT experiment aims to conduct a sensitive search of the neutrinoless double beta decay ($\beta\beta0\nu$) in ^{136}Xe, using high-pressure gas electroluminescent time projection chambers (HP-ELTPCs). Two dedicated readout planes, equipped with PMTs and SiPMs, are used to collect the primary and secondary (EL) scintillation light. While the PMTs provide the start time and the total energy of the events, the SiPMs provide their topological signatures. The NEXT-White detector, a first radiopure demonstrator, was operated between 2016 and 2021 in the Canfranc Underground Laboratory (LSC). This detector demonstrated the capabilities of the HP-ELTPC technology by providing a measurement of the two-neutrino mode of the $\beta\beta$ decay, as well as a $\beta\beta0\nu$ half-life limit of 1.3×10^{24} yr at 90\% C.L., using a fiducial mass of only 3.50±0.01 kg of ^{136}Xe. Following the decommissioning of NEXT-White, the NEXT-100 detector, which can hold up to ∼100 kg of Xe at 15 bar, has started operation in 2024 at the LSC. The goal of NEXT-100 is to prove the scalability of the NEXT technology and to provide the first competitive results on the $\beta\beta0\nu$ search. After a successful commissioning stage, the detector has been calibrated with low (^{83m}Kr) and high energy (^{228}Th) sources, reaching an energy resolution of around 1\% FWHM at the $Q_{\beta\beta}$ value (2.46 MeV), which meets the experimental target. Currently, NEXT-100 is undergoing a low-background data-taking campaign to measure and characterize the different background sources using ^{136}Xe-depleted xenon. With an expected background index below 10^{-3} counts/keV/kg/year, this detector is projected to reach a sensitivity of 6×10^{25} yr at 90\% C.L. after 3 years of data collection with ^{136}Xe-enriched xenon. Furthermore, NEXT-100 will lay the groundwork for the construction of a ton-scale detector, boosting the sensitivity above 10^{27} yr and establishing the ^{136}Xe HP-ELTPCs as major players in the quest for the discovery of the $\beta\beta0\nu$ decay.

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