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Search for Double Beta Decay Modes of ^{134}Xe with EXO-200 Phase-II and the prospect of this search in large-scale next-generation LXe detectors

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Neutrinoless double beta ($0\nu\beta\beta$) decay offers a means to explore whether neutrinos are massive Majorana fermions, i.e., their own antiparticles, and thus a portal between matter and antimatter. The EXO-200 experiment operated between 2011 and 2018 at the WIPP underground site in New Mexico, USA, setting some of the strongest constraints on the existence of this decay in ^{136}Xe . EXO-200 was a single-phase liquid xenon time projection chamber (LXe TPC) and used 200 kg of isotopically enriched liquid xenon (LXe) with 80% ^{136}Xe and 20% ^{134}Xe . ^{134}Xe , another double beta emitter with a Q energy of 825 keV, provides an opportunity to search for $0\nu\beta\beta$ decay with a second isotope of the same element within one detector, which allows to reduce uncertainties on the ratio of the decay probabilities. We present a search for double beta decay modes of ^{134}Xe with the EXO-200 Phase II dataset (2016-2018) featuring improved sensitivity with respect to a similar study performed with the Phase I run.

With several next-generation liquid-xenon based rare event search detectors on the horizon, exciting new possibilities come within reach to discover double beta decay of ^{134}Xe , which will be discussed along with the presented results from EXO-200.

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