The XENON1T experiment: Latest results on dark matter searches and first observation of double electron capture of 124Xe

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The XENON1T experiment was designed to search for weakly interacting massive particles (WIMPs) which are a very popular explanation for the nature of dark matter. The detector principle employs the dual-phase time projection chamber (TPC) technology with a liquid xenon target of 3.2 tons.

The ultra-low detector background level of 82 events/(t×yr×keV) as well as the unprecendented exposure of one tonne year allowed for the most stringent upper limit on spin-independent WIMP-nucleon cross-sections with a minimum of 4.1 · 10-47 cm² at a mass of 30 GeV/c2. Additionally, spin-dependent WIMP-nucleon and scalar WIMP-Pion interactions were probed with the acquired data with world-leading sensitivity as well.

Even though the experiment is optimized for low-energetic dark matter searches, the detector shows excellent performance at higher energies. Recently, XENON1T was able to observe for the first time the double electron capture of 124Xe. The measured half-life of 1.8 · 1022 yrs makes the decay the rarest process ever observed in a detector.

After an overview on the XENON1T experiment, the talk will present the latest results of dark matter searches beyond the standard WIMP model and then focus on the discovery of double electron capture of 124Xe with XENON1T.