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High-precision study of 2νββ of ^{130}Te from the CUORE experiment

Tuesday 26 August 2025 15:00 (20 minutes)

The two-neutrino double-beta decay (2νββ) of ^{130}Te offers a unique window into its underlying nuclear structure and provides essential benchmarks for neutrinoless double-beta decay (0νββ) searches. We present the most precise measurement to date of the 2νββ half-life of ^{130}Te from the CUORE experiment. The half-life, based on 1038 kg·yr TeO_2 exposure, is determined to be $T_2^{1/2} = (9.32^{+0.05}_{-0.04}(stat.)^{+0.07}_{-0.07}(syst.)) \cdot 10^{20}$ yr, marking a two-fold improvement in precision compared to previous measurements. Beyond refining the half-life measurement, this result leverages a 70% enhancement in signal-to-background ratio thereby enabling the first application of a spectral shape analysis using next-to-leading-order 2νββ formalism in ^{130}Te. This analysis extracts ratios of higher-order nuclear matrix elements—parameters that are notoriously challenging to probe experimentally. These results significantly advance double-beta decay physics, offering stringent constraints on nuclear models and enhancing the interpretive power of future 0νββ searches.

Collaboration you are representing

CUORE

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