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Search for time-reversal symmetry violation in neutron-nucleus system at J-PARC (NOPTREX: J-PARC E99)

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The fundamental parity violating effect caused by the hadronic weak interaction is enhanced by up to 10^6 times in neutron absorption reactions of 139La, 131Xe, 117Sn, and other nuclei. This enhancement can be explained by the mixing between s-wave and p-wave amplitudes of the compound nuclear state (s-p mixing model). Similarly, T-violating effect in the nucleon-nucleon interaction can also be largely enhanced in these systems through the same mechanism, suggesting the possibility of conducting a sensitive search for unknown T-violation using compound nucleus reactions. The NOPTREX (Neutron Optical Parity and Time Reversal Experiment) international collaboration is planning an experiment to explore unknown T-violation by measuring the P, T-odd cross-section between a polarized epithermal neutron beam and a polarized target (J-PARC E99). Recently, fundamental studies for the T-violation search experiment have been conducted, including the determination of T-violating enhancement factor using (n,γ) reaction measurements, enhanced P-violation measurements, an experiment using polarized neutrons and a polarized target, and these developments. We will provide an overview of the J-PARC E99 experiment and current status for the Phase-I T-violation search experiment.

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