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Final Results on the Rare Decay $KL \rightarrow \pi^0 \nu \bar{\nu}$ from the KEK E391a Experiment

The neutral-kaon decay $KL \rightarrow \pi^0 \nu \bar{\nu}$ is a direct CP-violating process caused by a flavor-changing neutral current, and the branching ratio is predicted to be $(2.49 \pm 0.39) \times 10^{-11}$ in the Standard Model. The rare decay is one of the processes expected to have a significant impact on new physics searches. The E391a experiment at the KEK 12-GeV proton synchrotron was the first dedicated search for $KL \rightarrow \pi^0 \nu \bar{\nu}$. The final results, which have just been published in Phys.Rev.D81, 072004 (2010), are reported in this contribution. Combining the data sets in February-April 2005 (Run-2) and October-December 2005 (Run-3), the single event sensitivity was 1.11×10^{-8} and no events were observed in the signal region. The upper limit on the branching ratio was set to be 2.6×10^{-8} at the 90% confidence level. The E391a experiment as a whole has improved the limit from the experiments (FNAL-KTeV, ...) by a factor of 20.

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