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Search for a massless dark photon in $KL \rightarrow \gamma + \text{dark photon}$ at the KOTO experiment

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We present the study of the massless dark photon in the $K_L^0 \rightarrow \gamma \tilde{\gamma}$ decay at the J-PARC KOTO experiment. The massless dark photon ($\tilde{\gamma}$) is different from the massive one because it has no direct mixing with the ordinary photon, but it could interact with the SM particles through direct coupling to the quarks. In some theoretical predictions, the $\mathcal{BR}(K_L^0 \rightarrow \gamma \tilde{\gamma})$ can be as large as $\mathcal{O}(10^{-3})$, which is well within the sensitivity of KOTO. Although the search for $K_L^0 \rightarrow \gamma \tilde{\gamma}$ could be challenging due to the lacking kinematic constraints, the hermetic veto system of KOTO provides a unique opportunity to probe for such decay. In this presentation, we will present the study of $K_L^0 \rightarrow \gamma \tilde{\gamma}$ based on the data collected in 2020.

In-person participation

No

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