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An axion-like particle explanation of $B \to \pi K$ puzzle and $B \to K\nu\bar{\nu}$ excess

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In light of the recent branching fraction measurement of $B^+ \to K^+\nu\bar{\nu}$-decay and its deviation from the SM expectation, we analyze the prospect of an axion-like particle (ALP) as the cause of such a departure. We assume a long-lived ALP with a mass of the order of a pion that predominantly decays to two photons. We focus on the scenario where the ALP decay length is several meters and therefore a non-negligible probability to decay outside detector volume of Belle-II mimicking the $B^+ \to K^+\nu\bar{\nu}$-signal. Remarkably, such an arrangement provides a simple explanation to the long-standing $B \to \pi K$-puzzle by noting that the measured $B^0 \to \pi^0 K^0$ and $B^+ \to \pi^0 K^+$ decays have a $B^0 \to aK^0$ and $B^+ \to aK^+$ component respectively. We also argue based on our results that the axion-photon effective coupling belongs to a region in the parameter space that is still allowed after considering all the constraints known from various experiments.

Mini Symposia (Invited Talks Only)

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