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FIMP dark matter at the KOTO experiment

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The KOTO experiment has reported an excess of $K_L \to \pi^0 \nu\bar{\nu}$ events above the standard model prediction, in tension with the Grossman–Nir bound. The GN bound heavily constrains new physics interpretations of an excess in this channel, but another possibility is that the observed events originate from a different process entirely: a decay of the form $K_L \to \pi^0 X$, where X denotes one or more new invisible species. We introduce a class of models to study this scenario with two light scalars playing the role of X, and we examine the possibility that the lighter of the two new states may also account for cosmological dark matter. We show that this species can be produced thermally in the presence of additional interactions apart from those needed to account for the KOTO excess. Conversely, in the minimal version of the model, dark matter must be produced non-thermally. In this case, avoiding overproduction imposes constraints on the structure of the low-energy theory. Moreover, this requirement carries significant implications for the scale of reheating in the early universe, generically preferring a low but observationally-permitted reheating temperature of 10 MeV. We discuss astrophysical and terrestrial signatures that will allow further tests of this paradigm in the coming years.

Is this abstract from experiment?

No

Internet talk

Yes

Name of experiment and experimental site

N/A

Is the speaker for that presentation defined?

Yes

Details

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