Non-Minimal Kaluza–Klein Dark Matter

Henrik Melbéus

Royal Institute of Technology, Stockholm, Sweden

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Outline

- Collaborators:
  - Johan Bonnevier
  - Mattias Blennow
  - Alexander Merle
  - Tommy Ohlsson

Universal Extra Dimensions

- One of the most popular extra-dimensional extensions of the SM
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- Remnant of translational invariance
  $\Rightarrow$ Conservation of KK parity $(-1)^n$
- Lower bound: $R^{-1} > 300$ GeV

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- $m_{\text{LKP}} \simeq R^{-1} = \mathcal{O}(1\ \text{TeV})$
- Possible WIMP DM candidate

The LKP

- The identity of the LKP depends on the UED mass spectrum
- Minimal UED: B^1 is the LKP (Cheng, Matchev, Schmaltz [hep-ph/0204342])
  - Compare to assumptions regarding SUSY breaking terms
- Non-minimal UEDs could give other LKPs (Flacke, Menon, Phalen [0811.1598])
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  - ν^1 — Excluded by direct detection (Servant, Tait [hep-ph/0209262])

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- h^1
  - Without coannihilations: $m_{h^1} \simeq 3$ TeV (preliminary)

Direct Detection

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- H^1:
  - Unknown, but presumably small due to the large preferred mass

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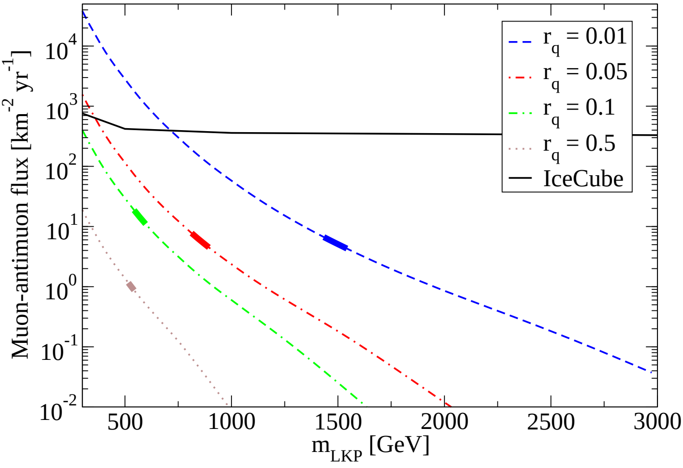
- H^1:
  - Scalar, too strongly constrained by direct detection to be observable in indirect neutrino signals

Neutrinos From the Sun — B^1



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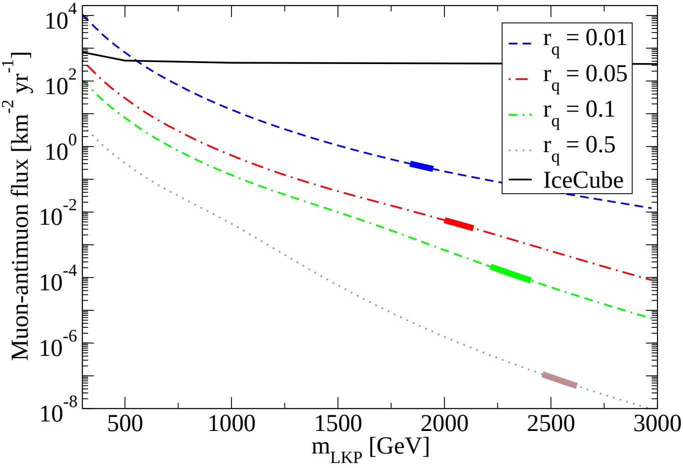
Neutrinos from the Sun — Z^1



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- Z^1:
  - Similar conclusions as for B^1, even though Z^1 is twice as massive (J. Bonnevier, H. M., A. Merle, T. Ohlsson [1104.1430])

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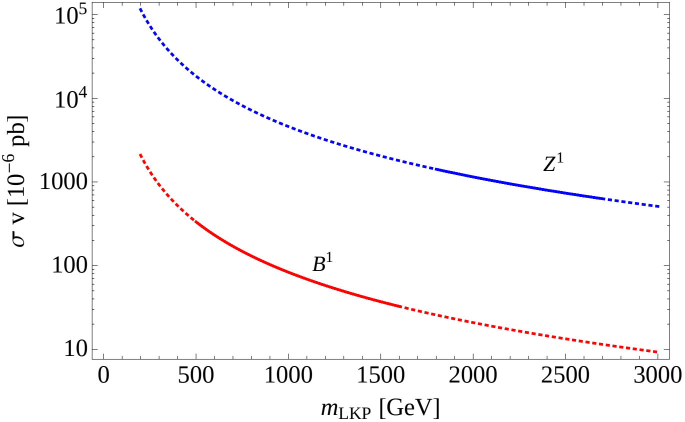

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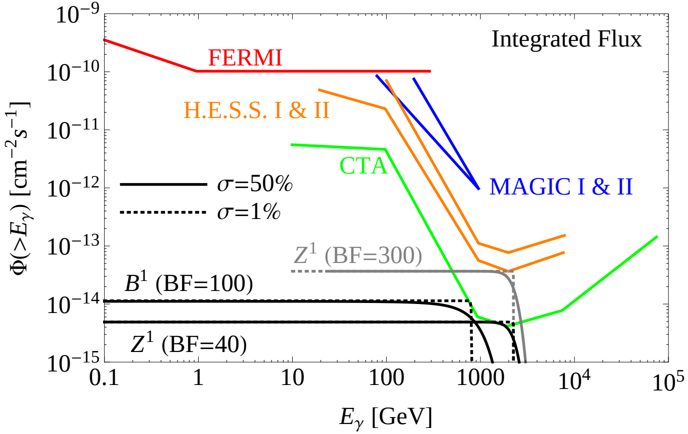

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Summary

- Possible non-minimal KKDM candidates are the B^1, Z^1 and H^1
- B^1: Possibly detectable in direct detection experiments, as well as indirect neutrino and gamma-ray searches
- Z^1: Heavier than B^1, and hence harder to detect, but perhaps possible in gamma-ray searches
- H^1: Even heavier, and more difficult to detect

The End

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- Thank you for listening!