Hidden Sector Dark Matter Models for the Galactic Center Gamma-Ray Excess

Asher Berlin

In collaboration with Pierre Gratia, Dan Hooper, and Sam McDermott

arXiv:1405.5204 [hep-ph]

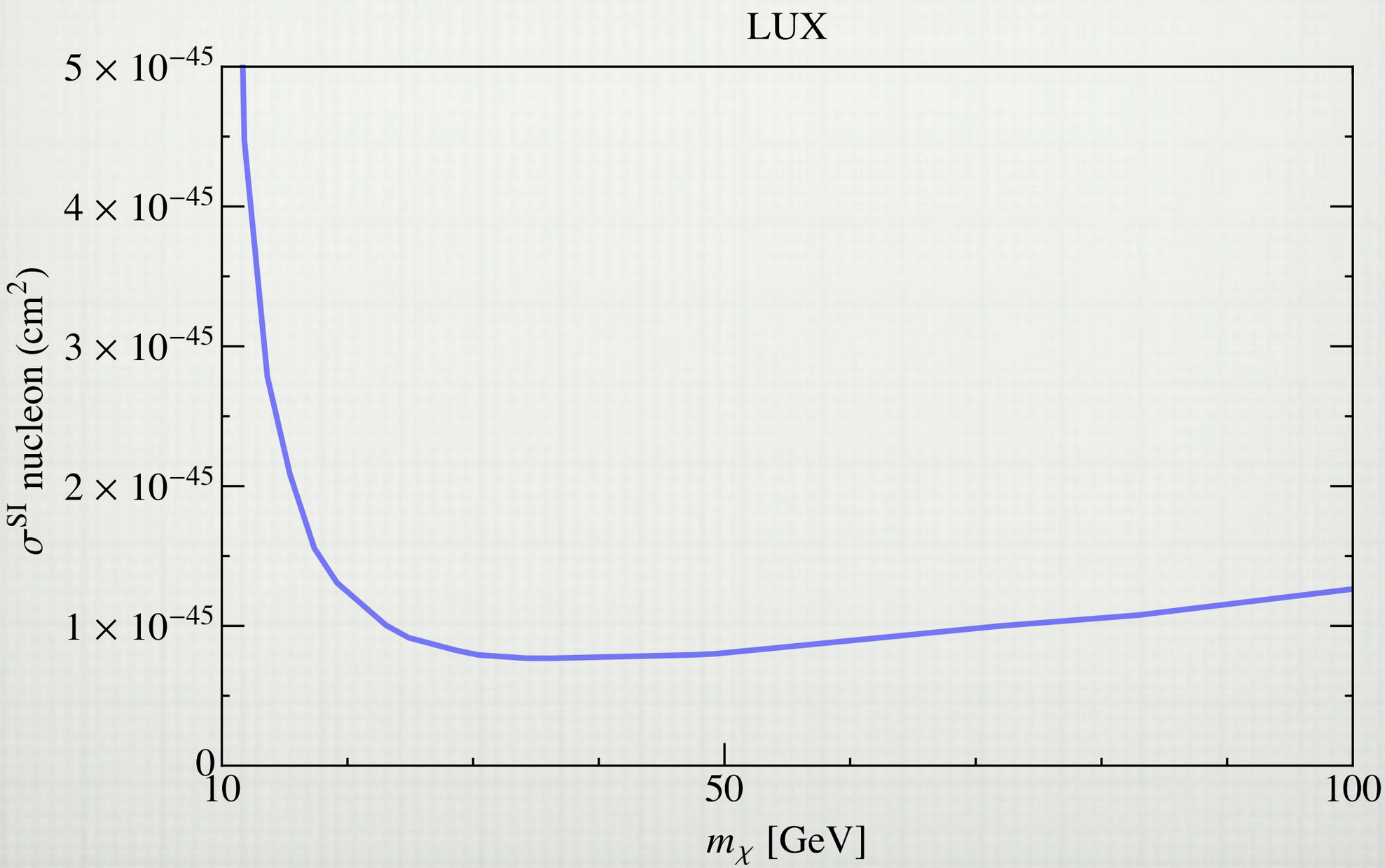
See also:

1405.0272, 1404.6528, 1404.4977

THE UNIVERSITY OF CHICAGO

COSMO' 14

15-40 GeV Dark Matter... What about LUX?



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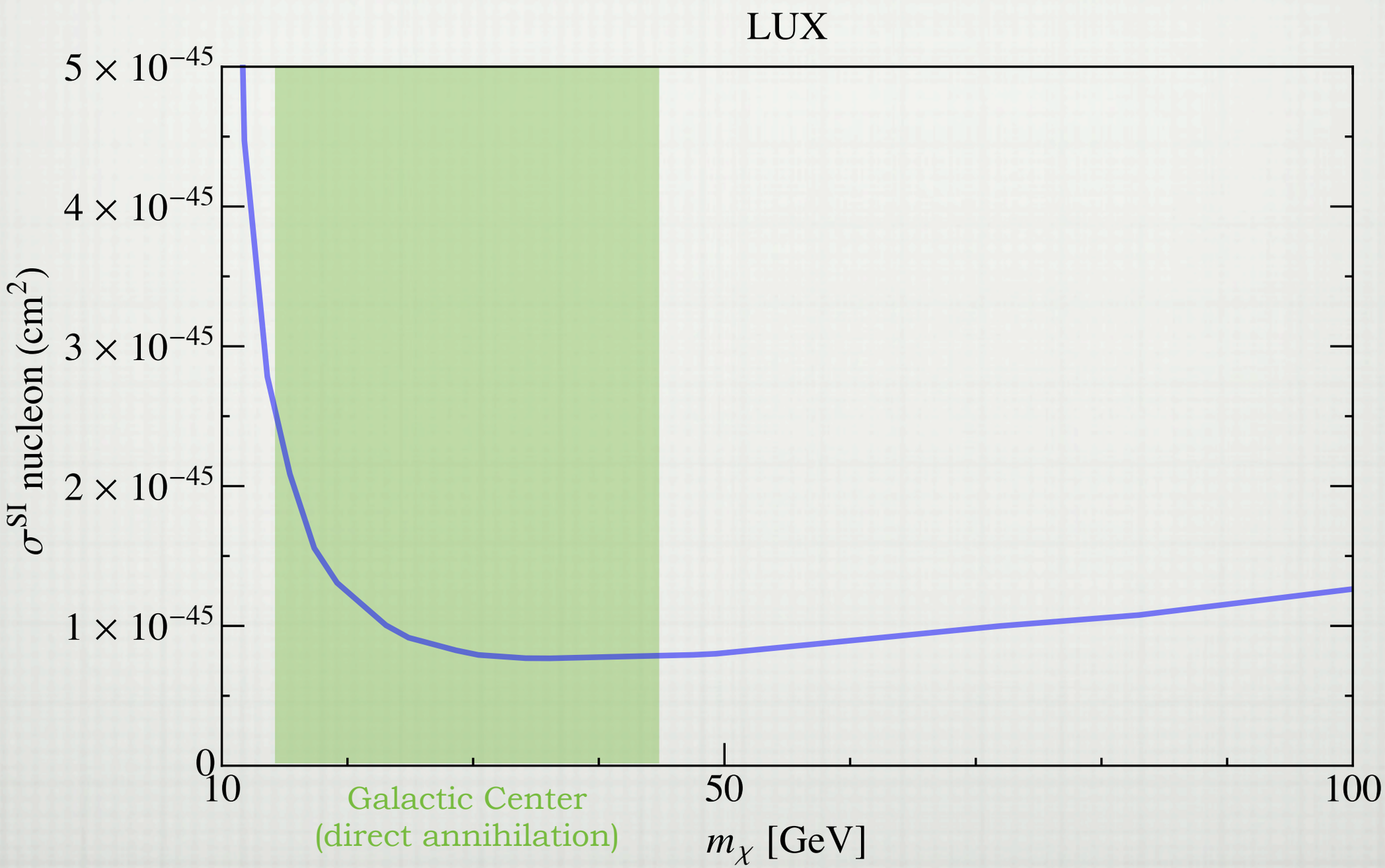

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- The decay of the intermediate states to SM fermions yields a photon-spectrum. These *cascade decays* result in a somewhat different fit to the GC excess.
- Nucleon scattering is <u>suppressed</u>, but annihilation is <u>unsuppressed</u>.

A Generic Example

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- Compared to direct annihilations, cascade annihilations prefer DM masses about twice as large.

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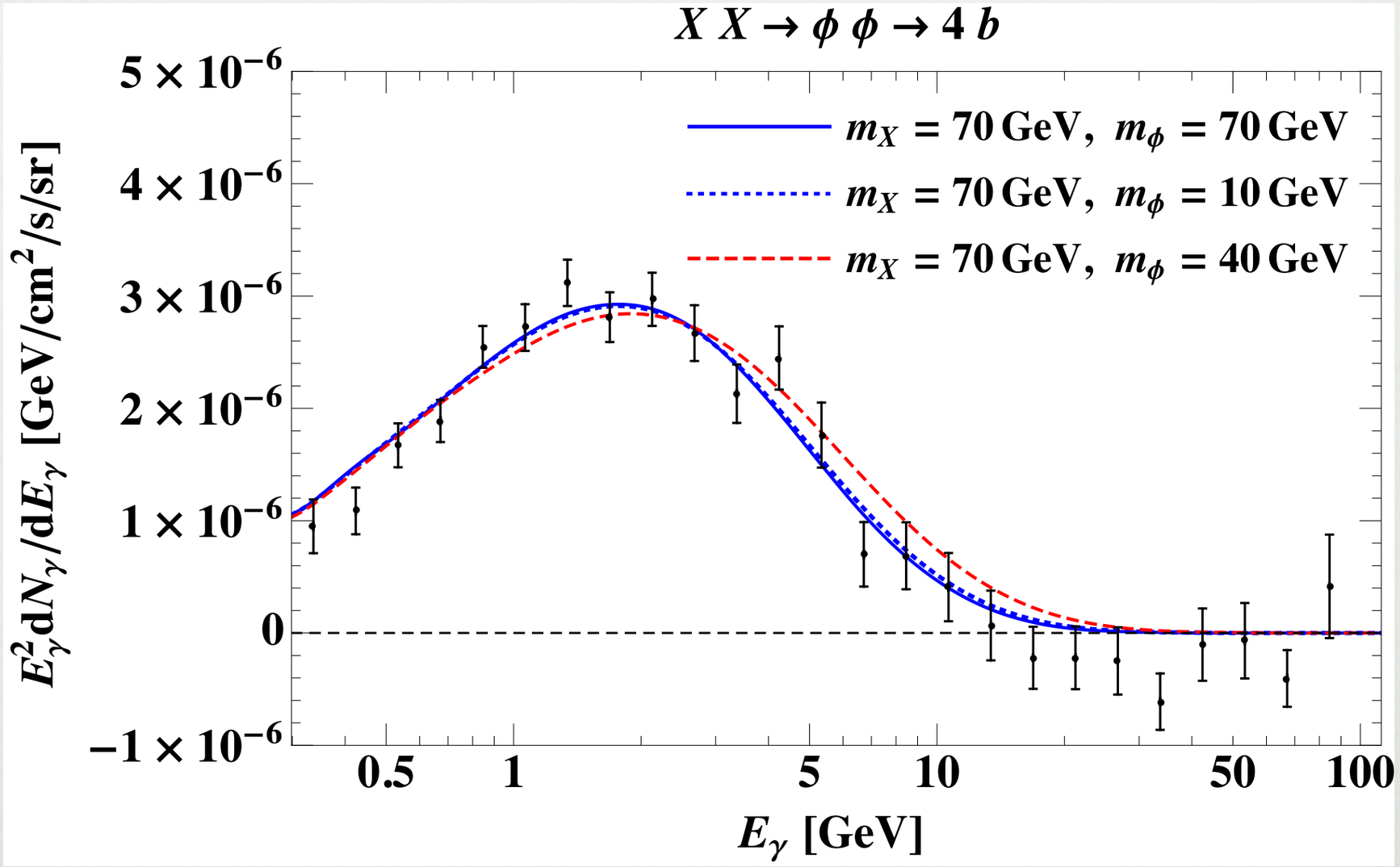

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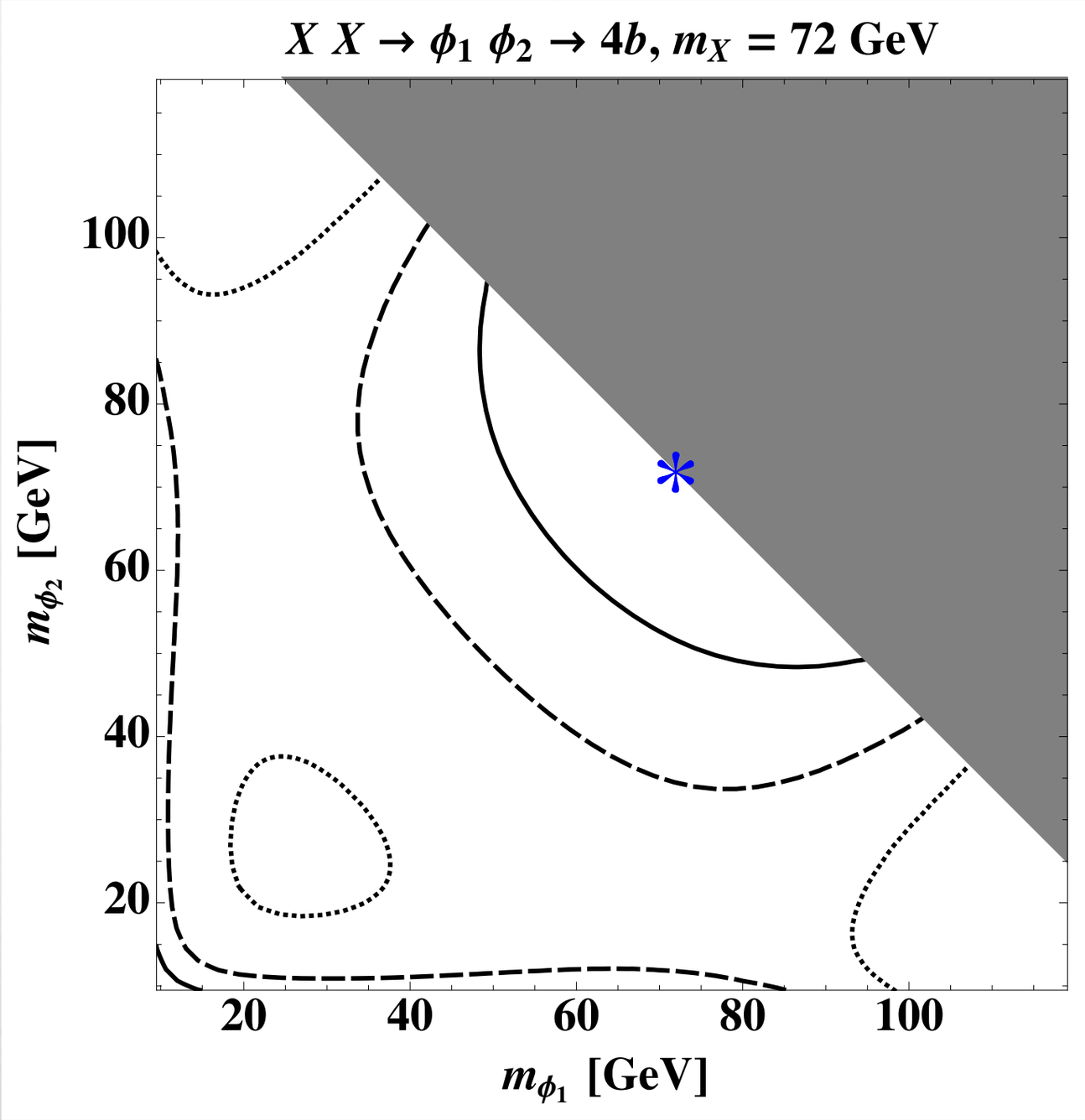

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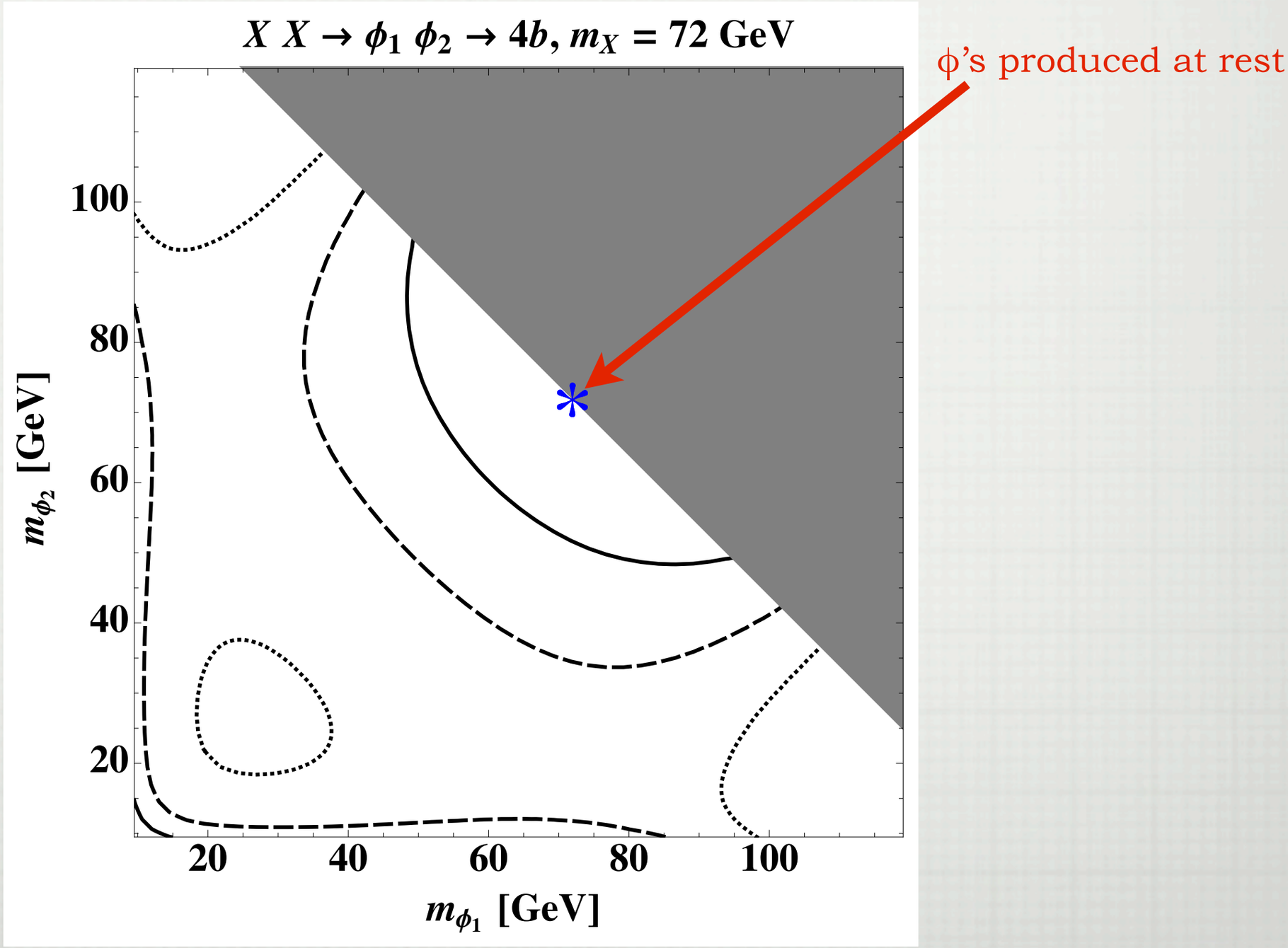

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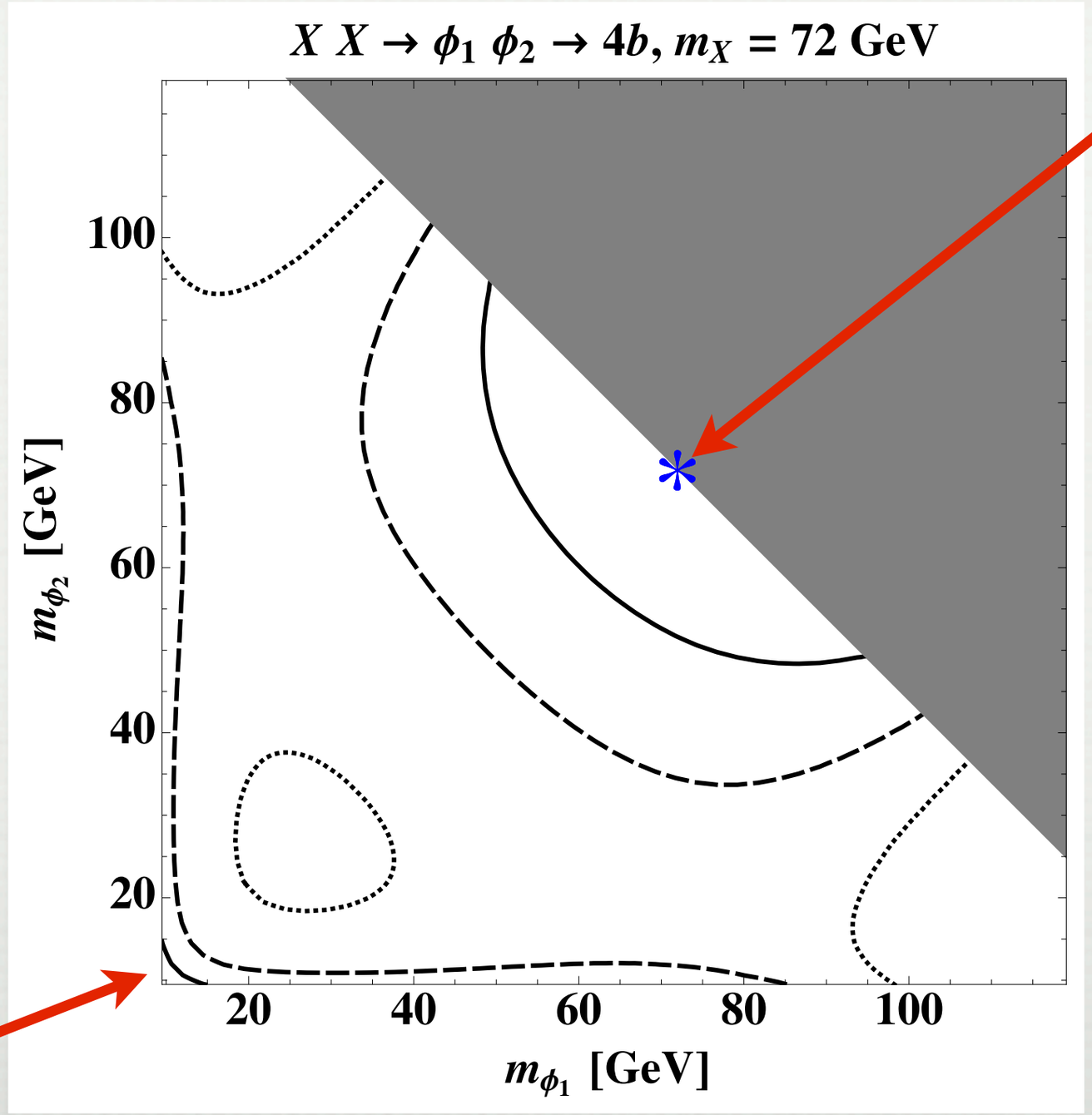

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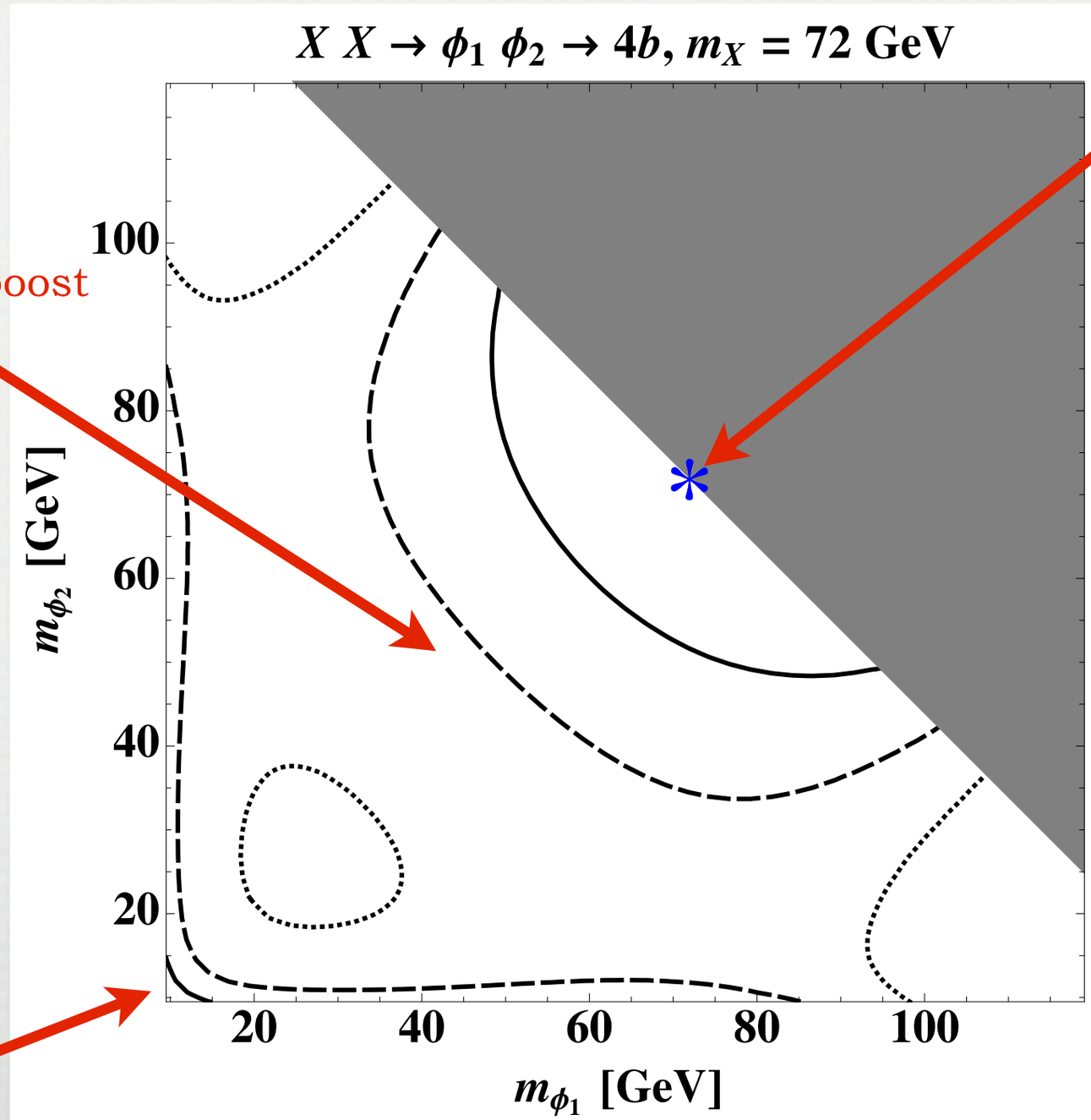

Combined ϕ and b boost

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m_X=60-80 GeV is "good" fit

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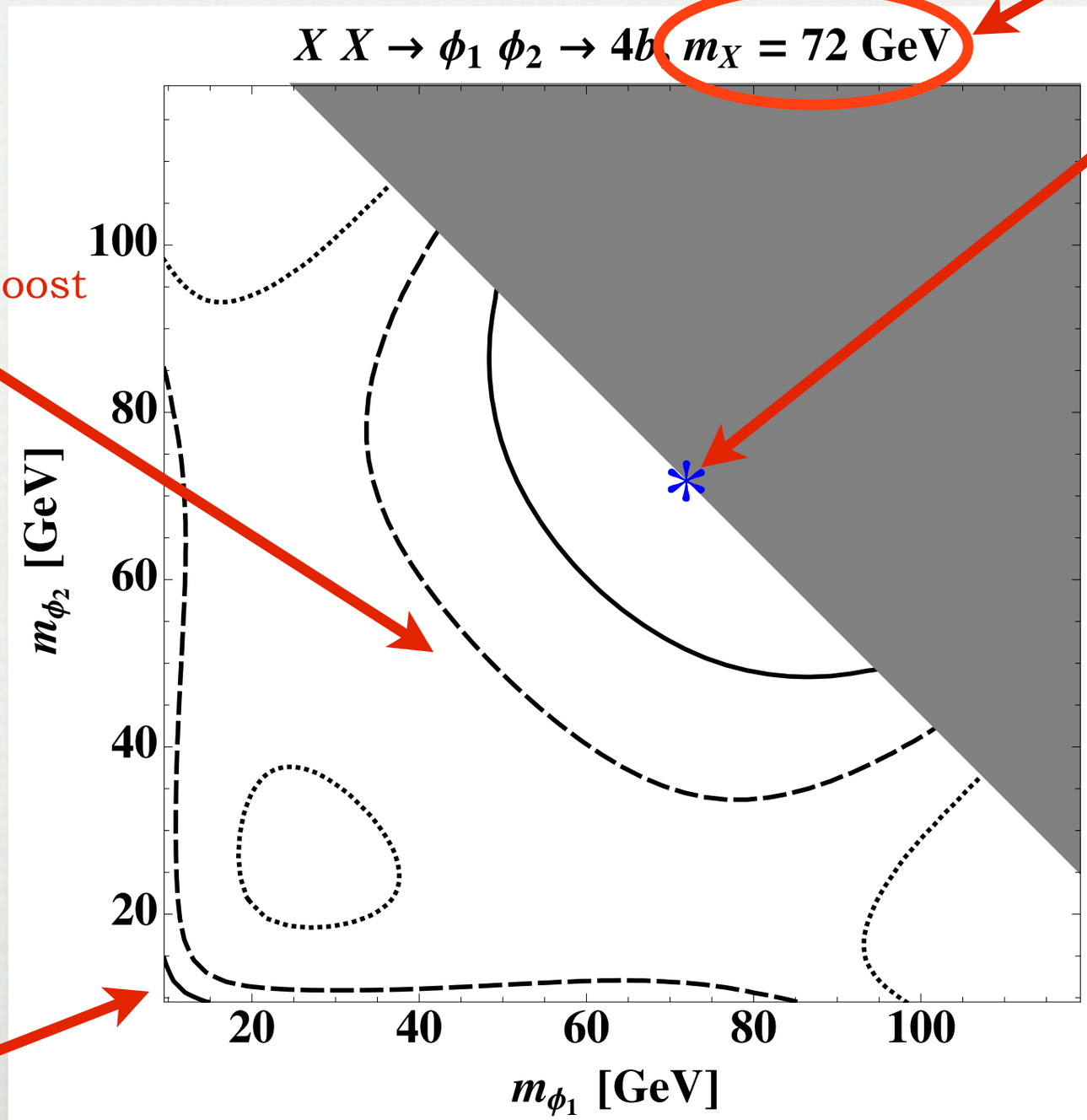

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- All these factors produce tension in the normalization of the signal, but can be compensated by adjusting mass of Milky way profile (which is uncertain by O(1) factor).

An Actual Model

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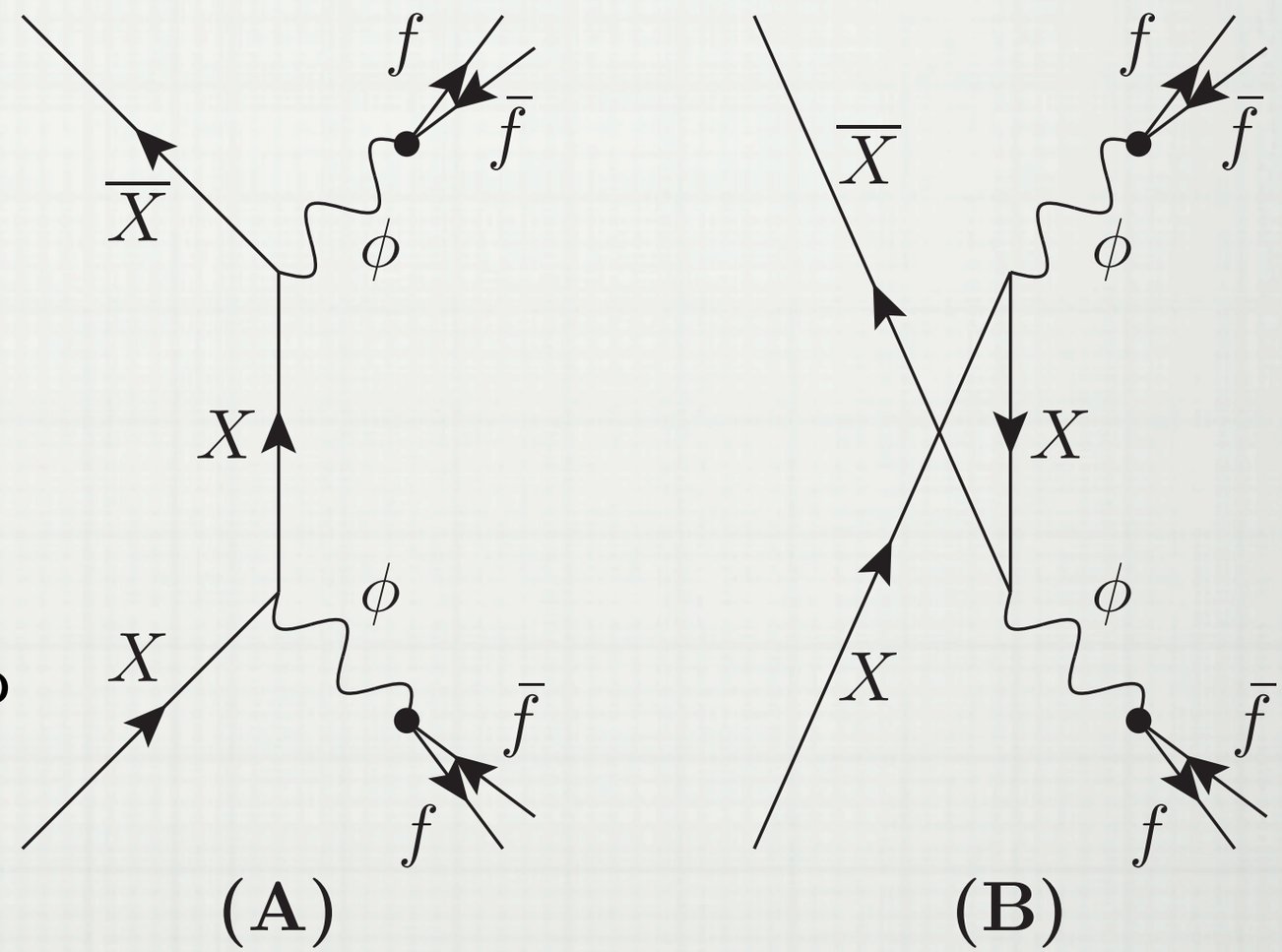

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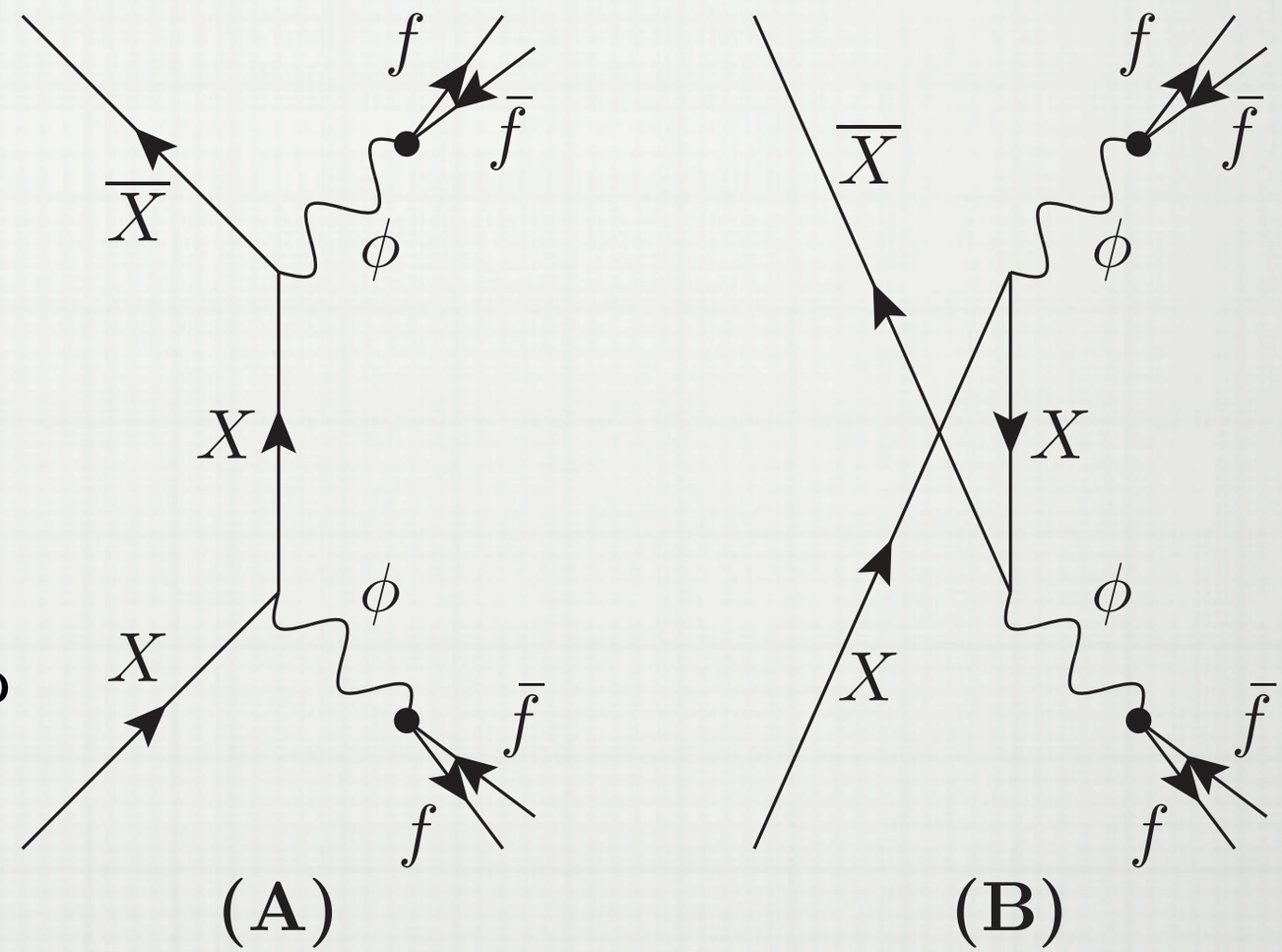

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Naturally, ~10^{-4}, avoiding limits from LUX

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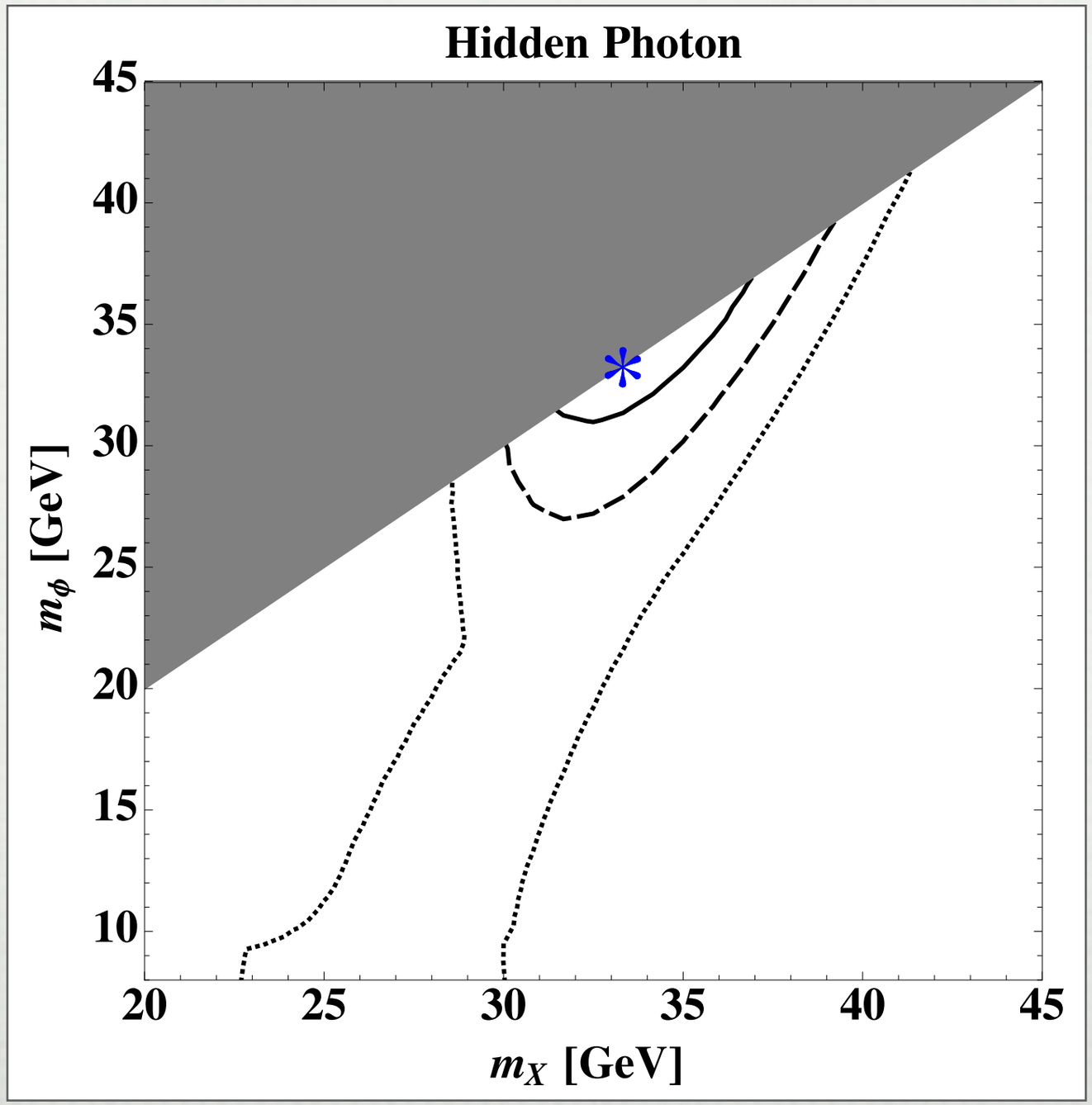
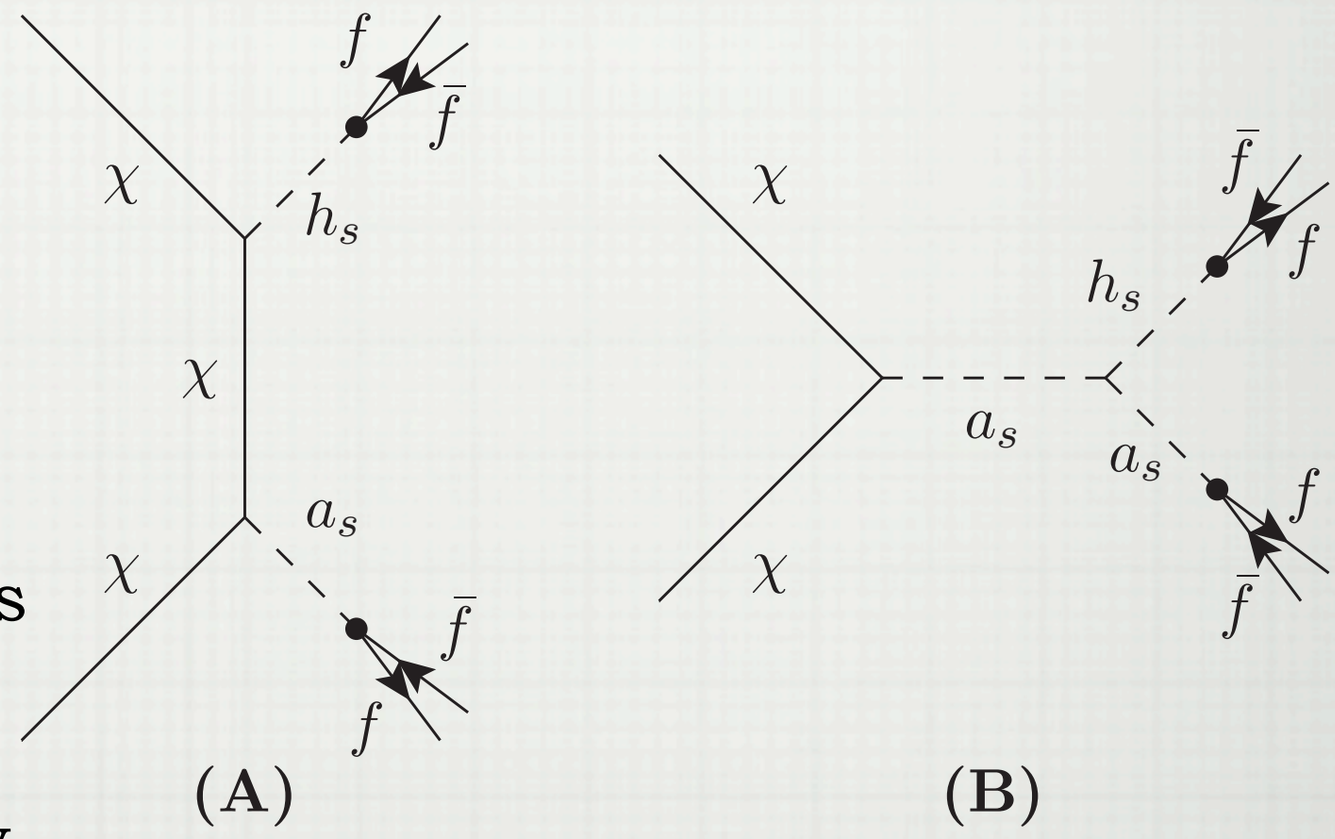

Hidden Photon
45
40
35
30
25
20
15
10
m_ϕ [GeV]
20
25
30
35
40
45
m_X [GeV]

Thank you

Backup Slides

NMSSM

- Neutralino LSP, which is dominantly singlino-like.
- If $m_{h_s} + m_{a_s} < 2m_\chi$, then $\chi\chi \to h_s a_s$
- If light singlet-like Higgses have small mass mixing with MSSM Higgses, then they predominantly decay to SM fermions.



$$W^{\text{Higgs}} = (\mu + \lambda\hat{S})\hat{H}_u\hat{H}_d + \xi_F\hat{S} + \frac{1}{2}\mu'\hat{S}^2 + \frac{1}{3}\kappa\hat{S}^3$$

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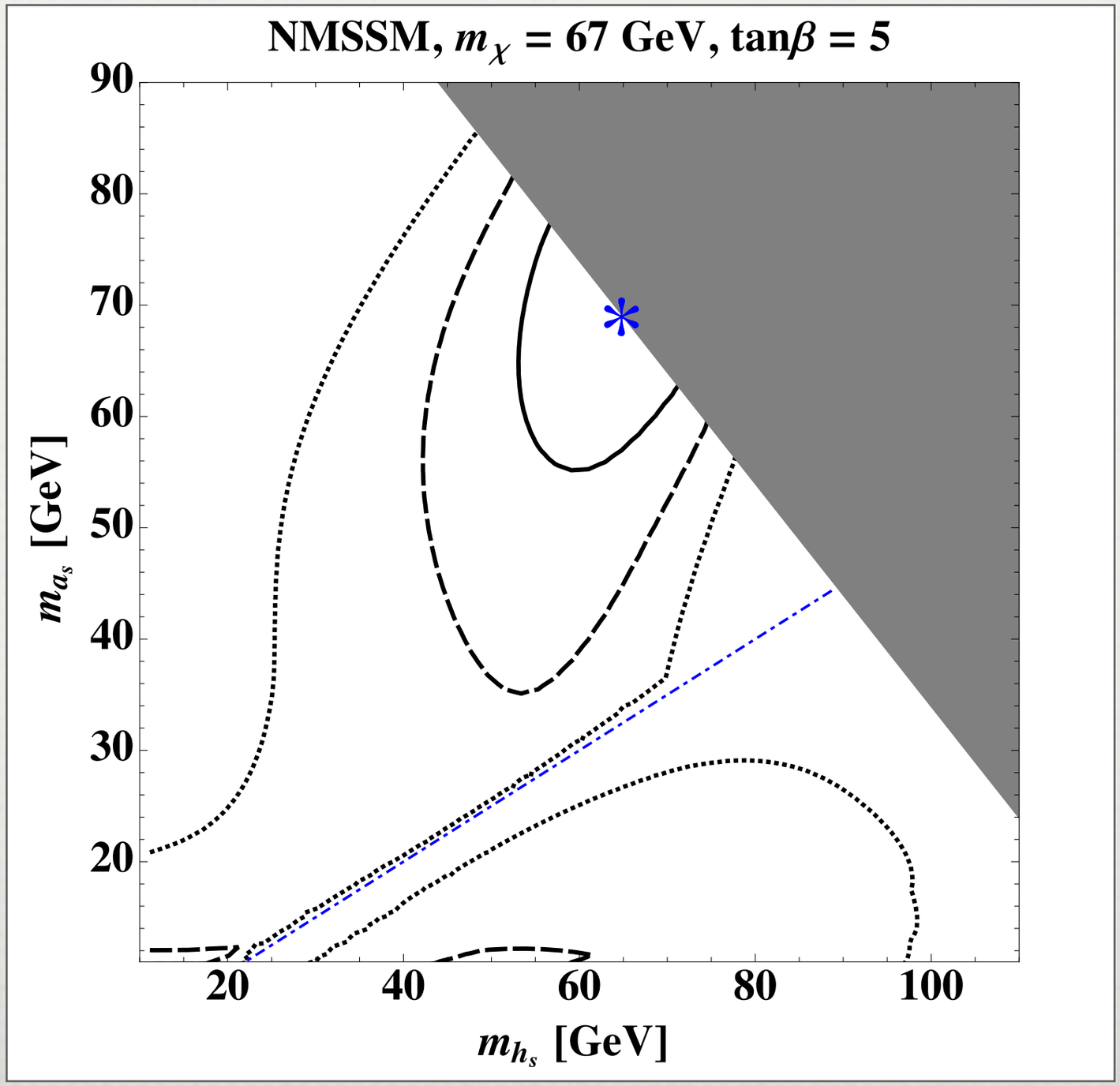
NSSM


NMSSM, m_χ = 67 GeV, tanβ = 5
90
80
70
60
50
40
30
20
m_{a_s} [GeV]
20
40
60
80
100
m_{h_s} [GeV]