

Not-so-inelastic Dark Matter (niDM)

Giovani Dalla Valle Garcia, Felix Kahlhoefer, Maksym Ovchynnikov and Thomas Schwetz

a simple UV-complete sub-GeV WIMP model

Majorana Fermions DM

$$\chi \chi^*$$

NEW FORCE: $U'(1)$

a massive Dark Photon

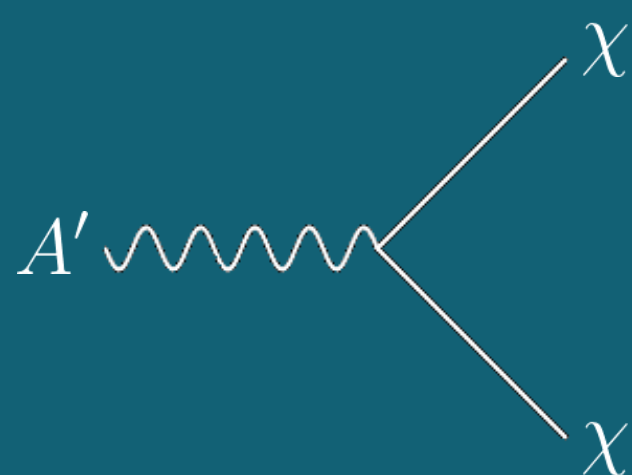
$$A'$$

Parameters

$$m_{\chi^*} = (1 + \Delta_m)m_\chi$$

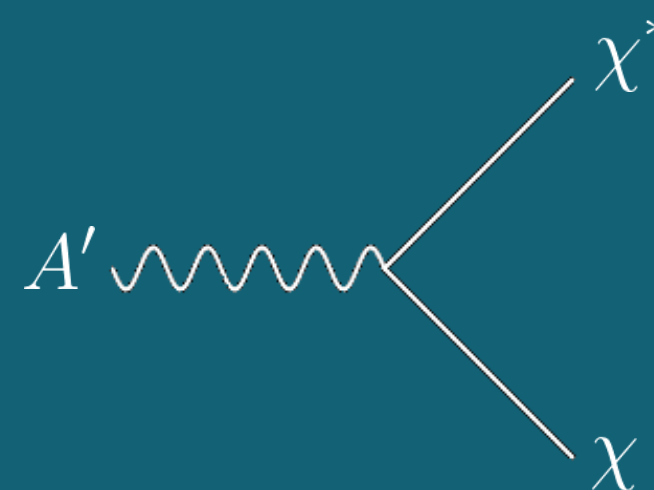
$$m_R = (1 + \delta_y)m_L$$

elastic



$$\alpha'_{el} = \alpha' \cos^2 2\theta$$

inelastic



$$\alpha'_{inel} = \alpha' \sin^2 2\theta$$

$$\cos 2\theta = -\frac{\delta_y \Delta_m}{(2 + \delta_y)(2 + \Delta_m)}$$

**SM-DM
mediation**

$$\gamma \text{ wavy line } A' \propto \epsilon \epsilon$$

iDM: $\delta_y = 0$

niDM: $\delta_y \neq 0$



Hunting Invisibles: Dark sectors, Dark matter and Neutrinos



arXiv:2405.08081

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Parity breaking



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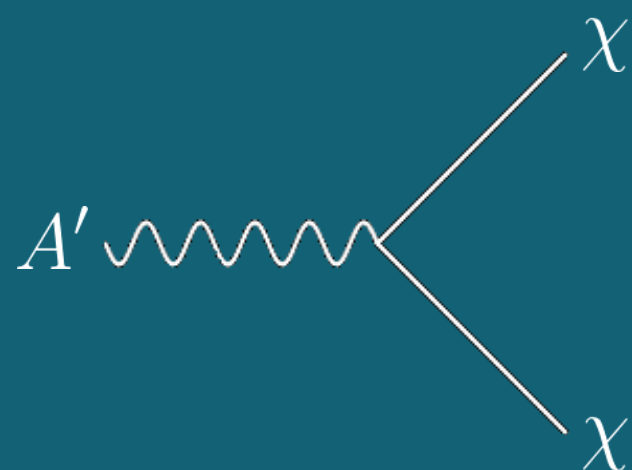
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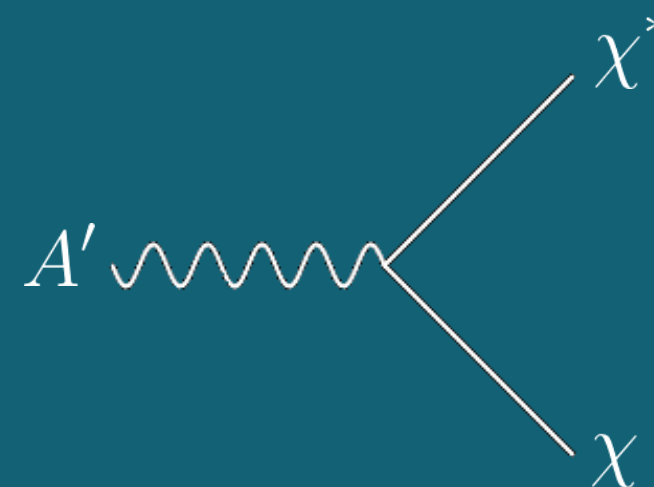
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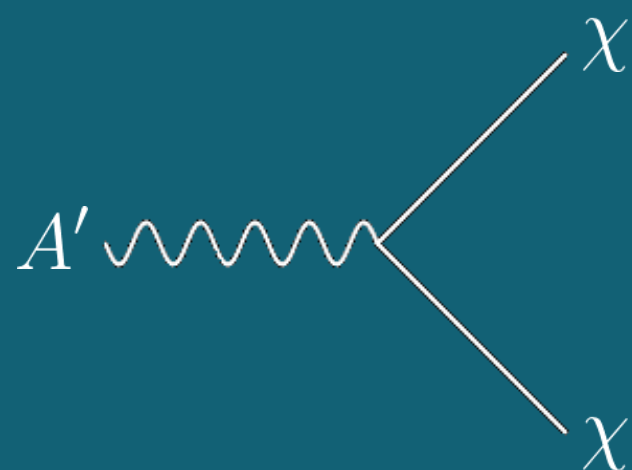
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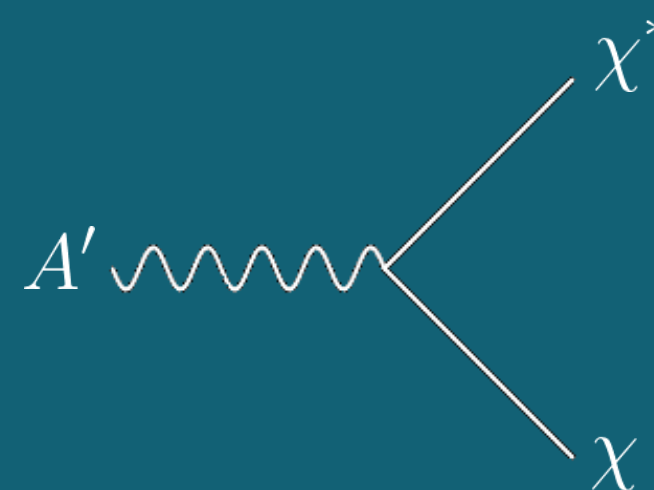
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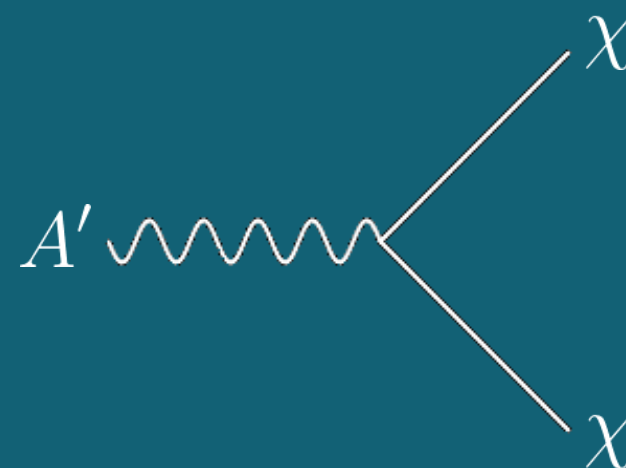
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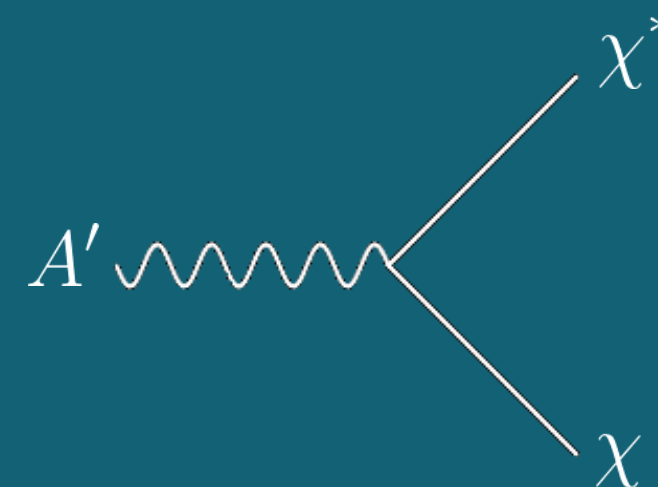
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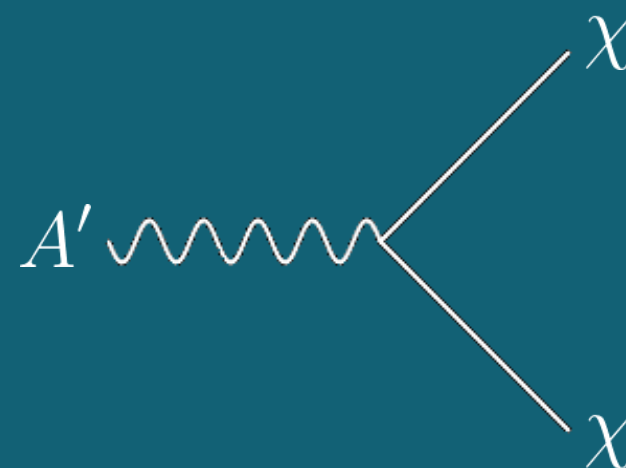
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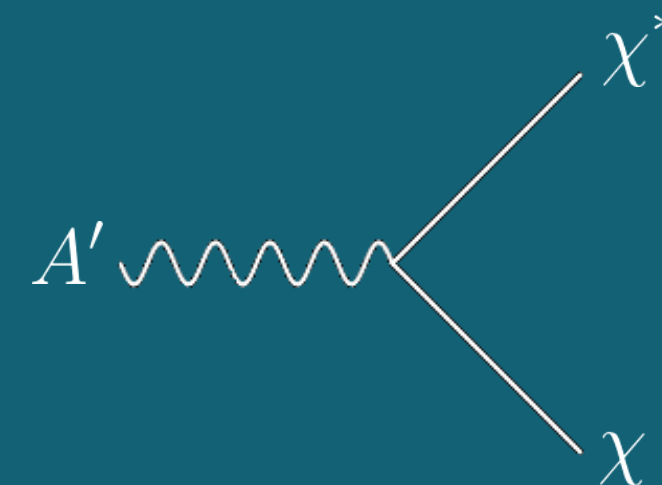
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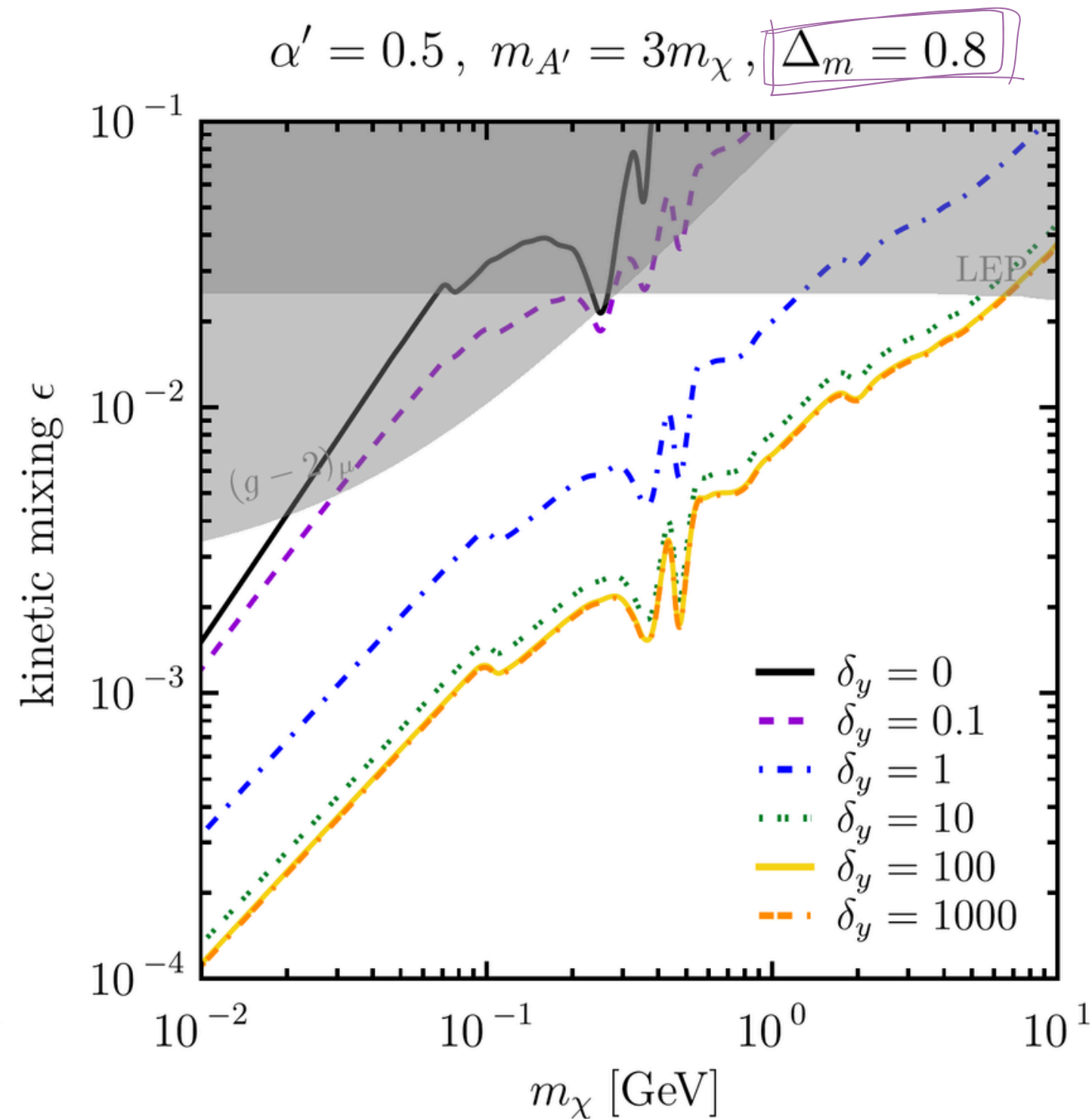
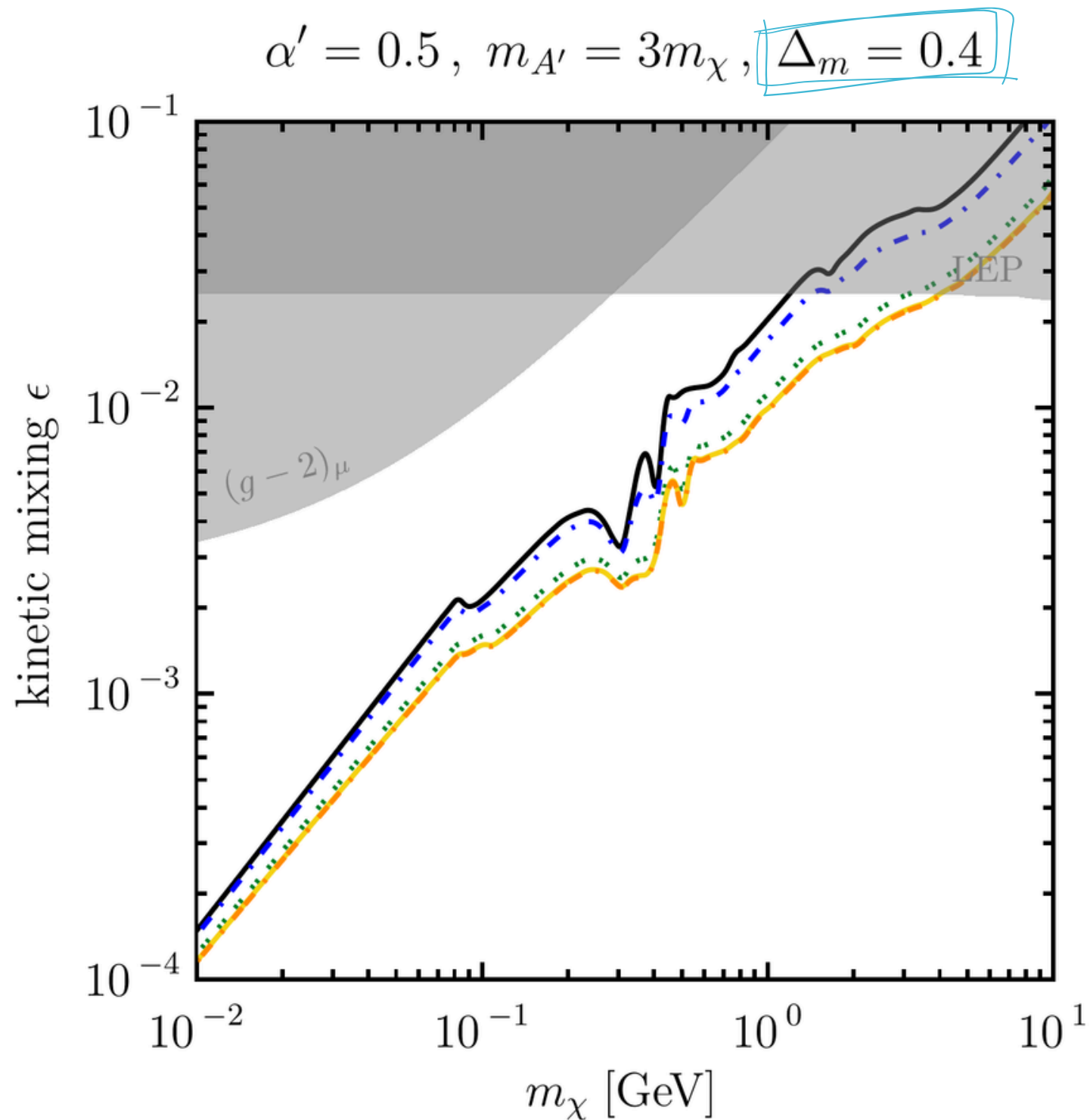


iDM: $\delta_y = 0$

niDM: $\delta_y \neq 0$

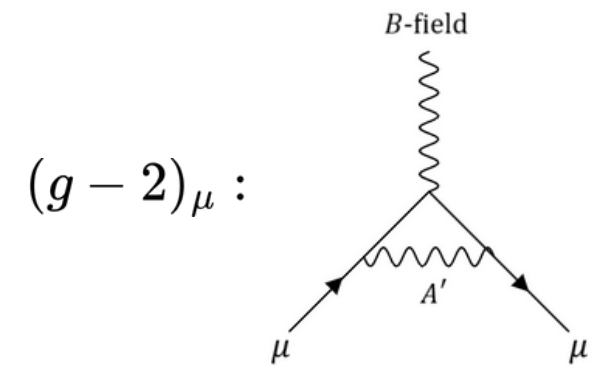
niDM - Relic abundance

Standard Freeze-out



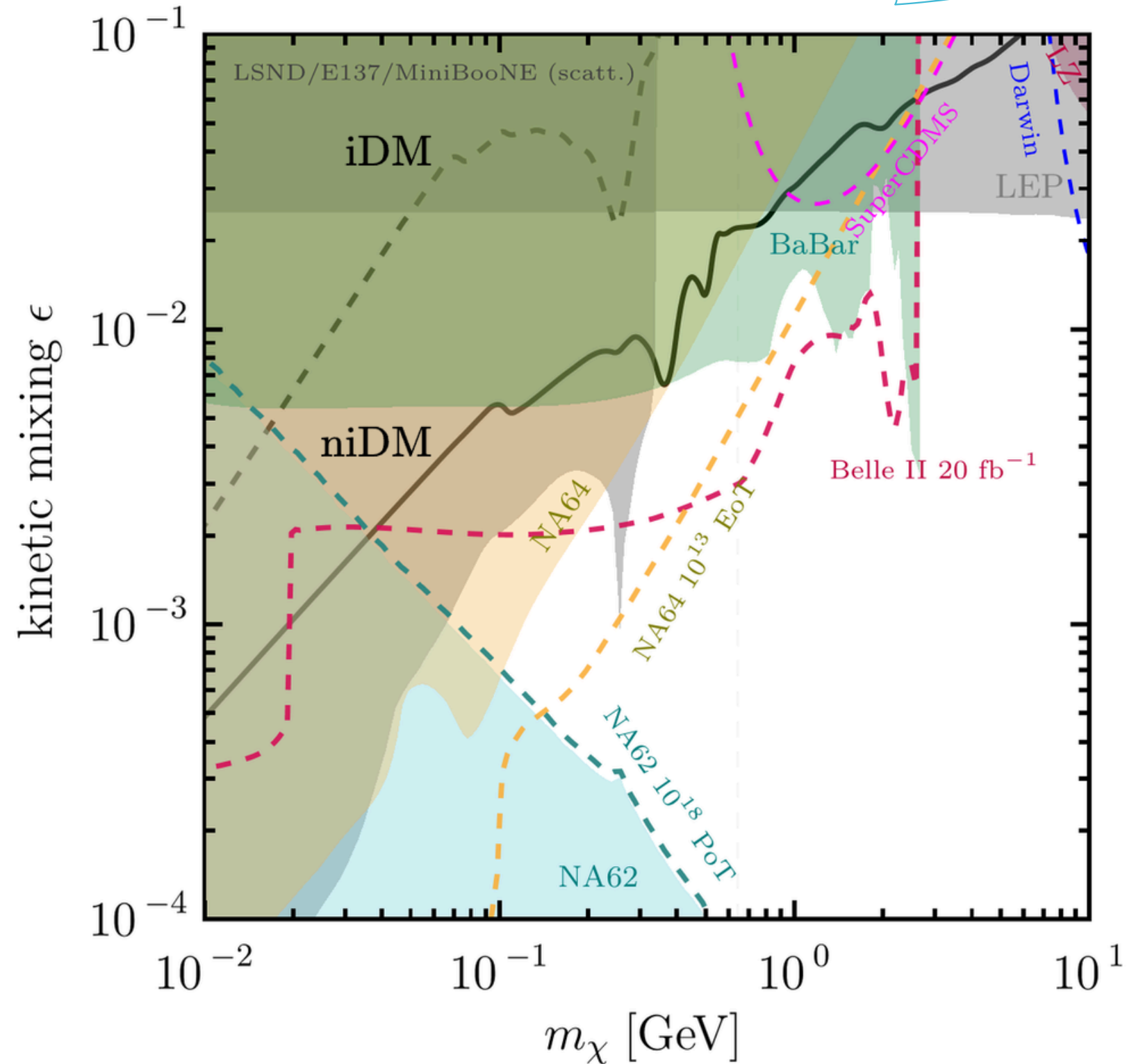
$$\frac{n_{\chi^*}}{n_\chi} \propto e^{-\Delta_m x_f}, x_f \approx 20$$

$$\alpha'_{\text{el}} = \alpha' \left(\frac{\delta_y \Delta_m}{(2 + \delta_y)(2 + \Delta_m)} \right)^2$$

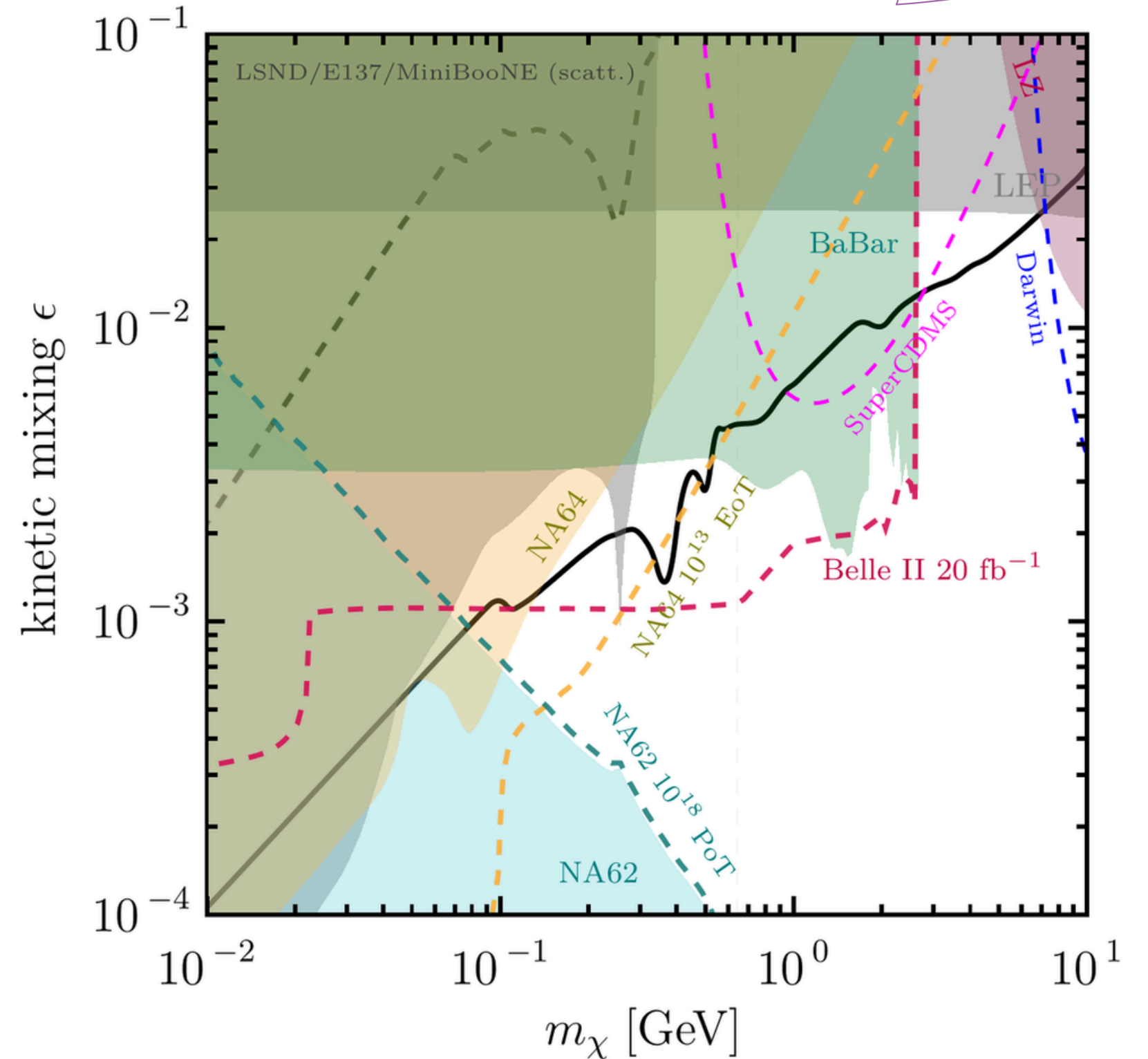


niDM - SEARCHES

$$\alpha' = 0.5, m_{A'} = 3m_\chi, \Delta_m = 0.9, \delta_y = 0.5$$



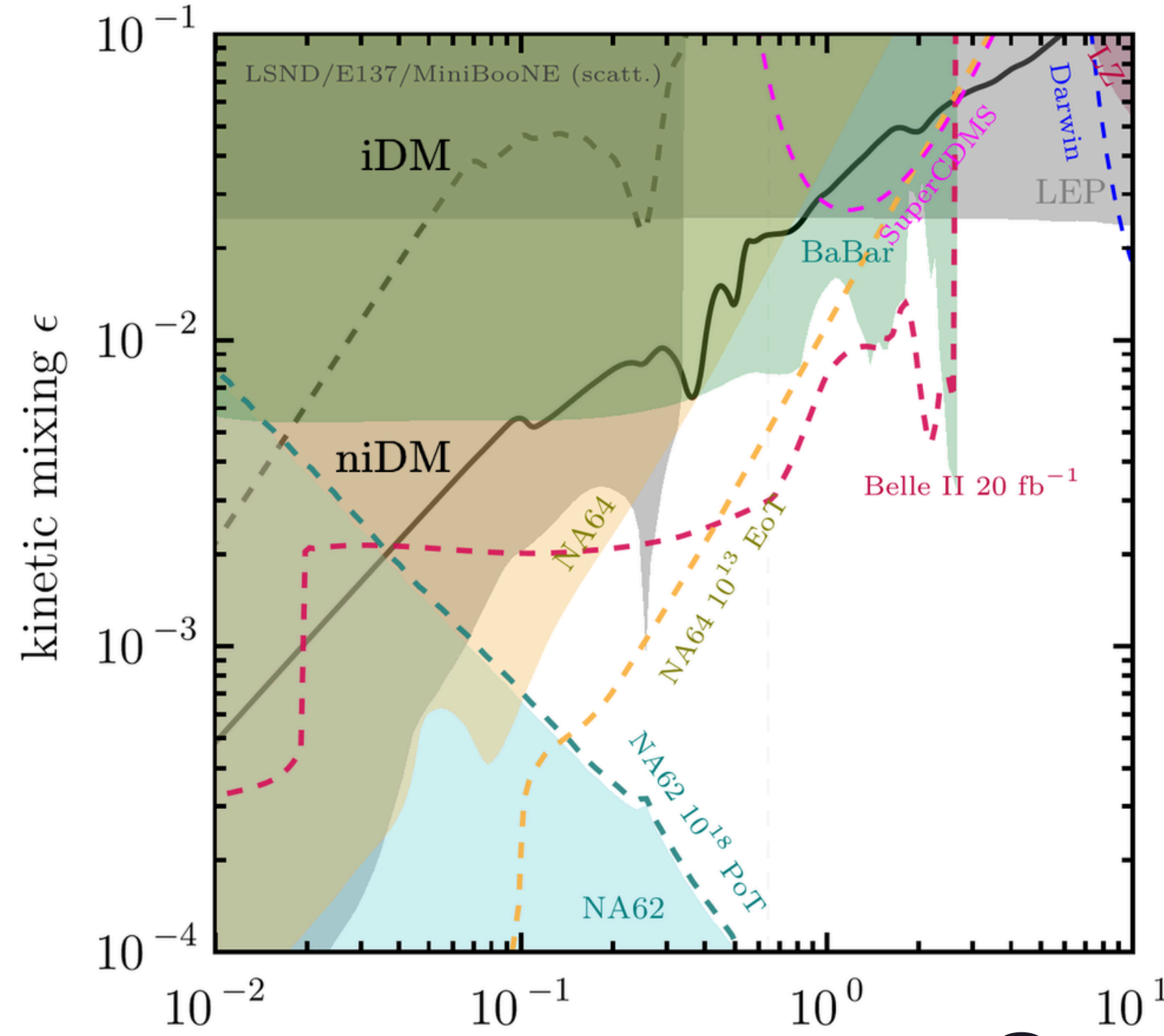
$$\alpha' = 0.5, m_{A'} = 3m_\chi, \Delta_m = 0.9, \delta_y = 50$$





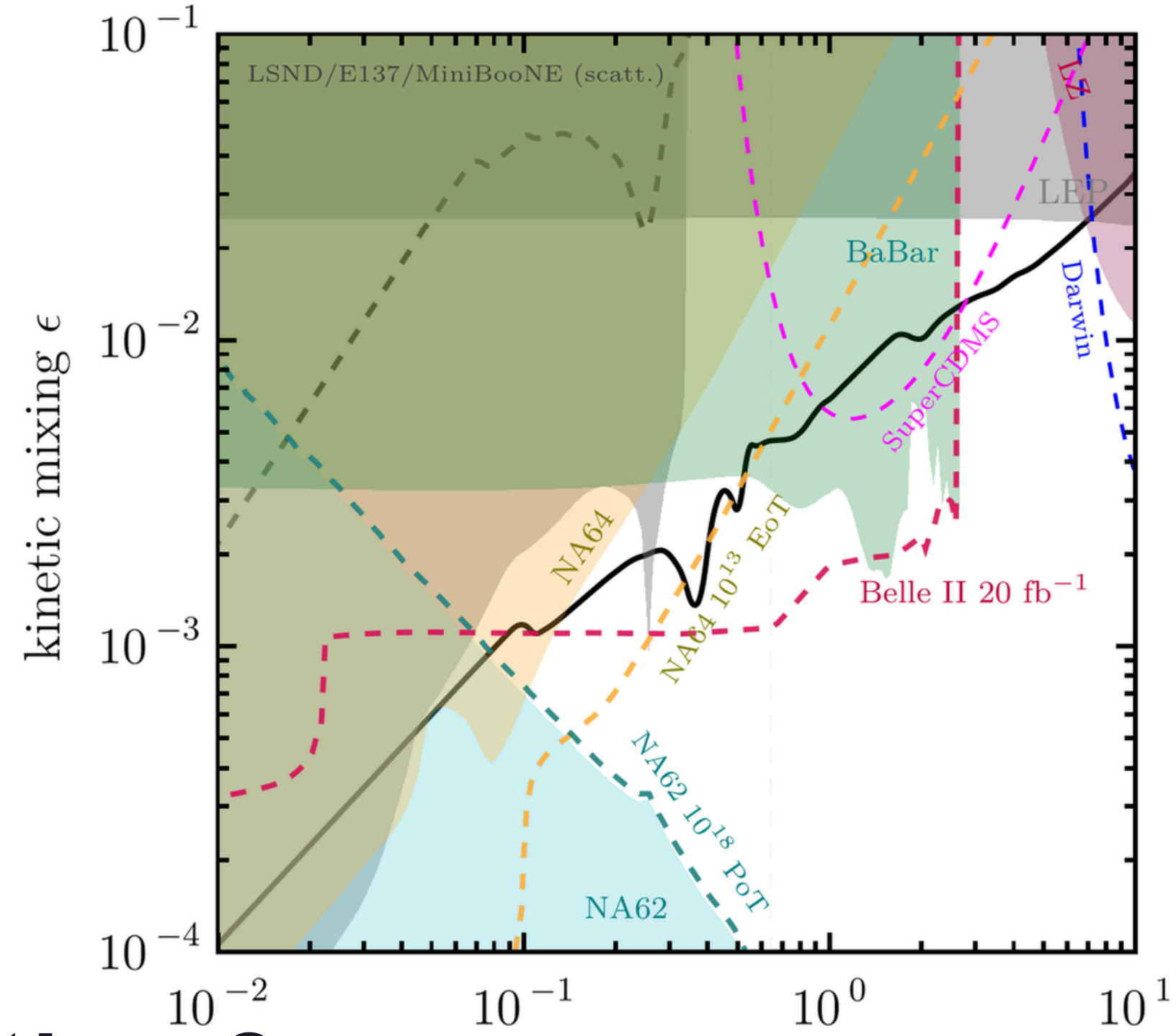
THANK YOU!

$\alpha' = 0.5, m_{A'} = 3m_\chi, \Delta_m = 0.9, \delta_y = 0.5$



More on my poster... m_χ [GeV]

$\alpha' = 0.5, m_{A'} = 3m_\chi, \Delta_m = 0.9, \delta_y = 50$



m_χ [GeV] Come check!

Questions?



BACKUP SLIDES

Not-so-inelastic Dark Matter (niDM)

A simplified sub-GeV WIMP model

Dirac Fermion DM

$$\chi = \chi_L + \chi_R$$

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$$A'$$

SSB: $V(H')$

Dark Higgs

$$H'$$

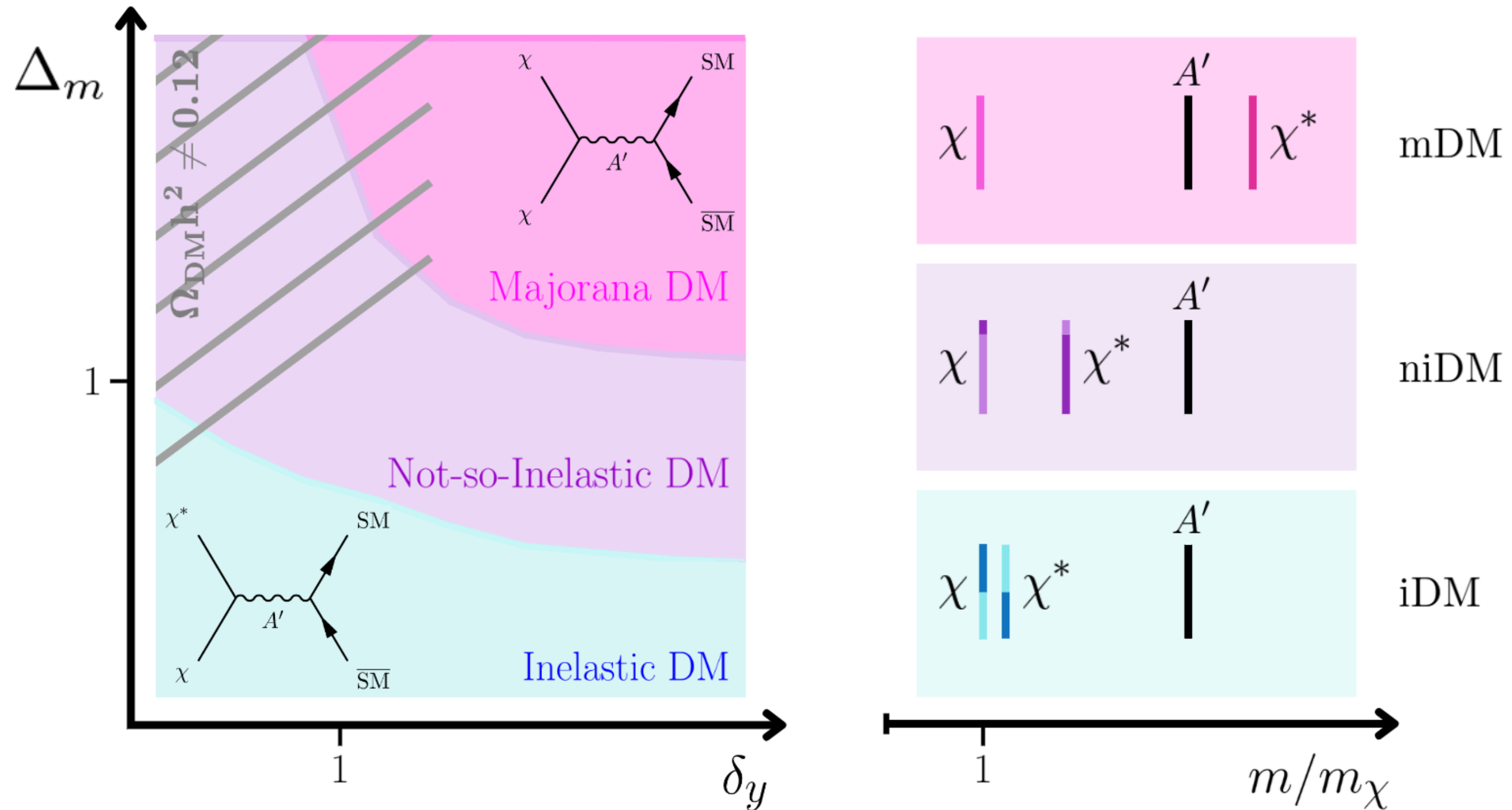
we assume:

$$m_{H'} > m_{A'} \quad \sin \theta_{HH'} \lesssim \epsilon$$

$$\mathcal{L}_\chi^I \supset ie' A'_\mu \bar{\chi} \gamma^\mu \chi - \sqrt{2} y_L H' \bar{\chi}^c P_L \chi - \sqrt{2} y_R H' \bar{\chi}^c P_R \chi + \text{h.c.}$$

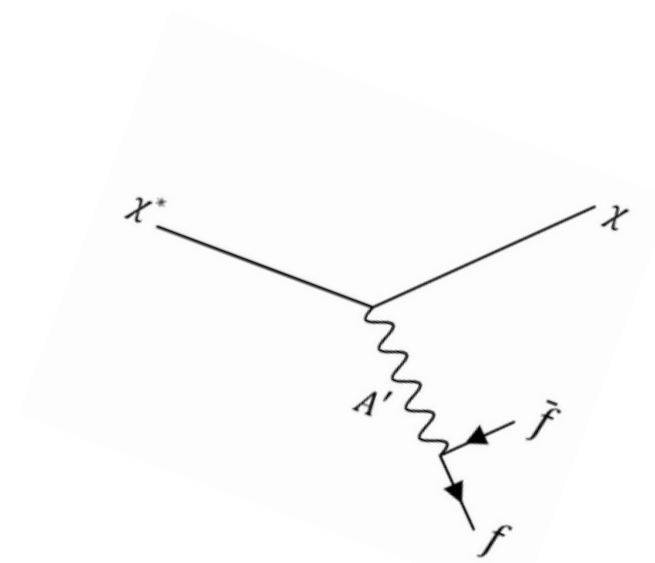
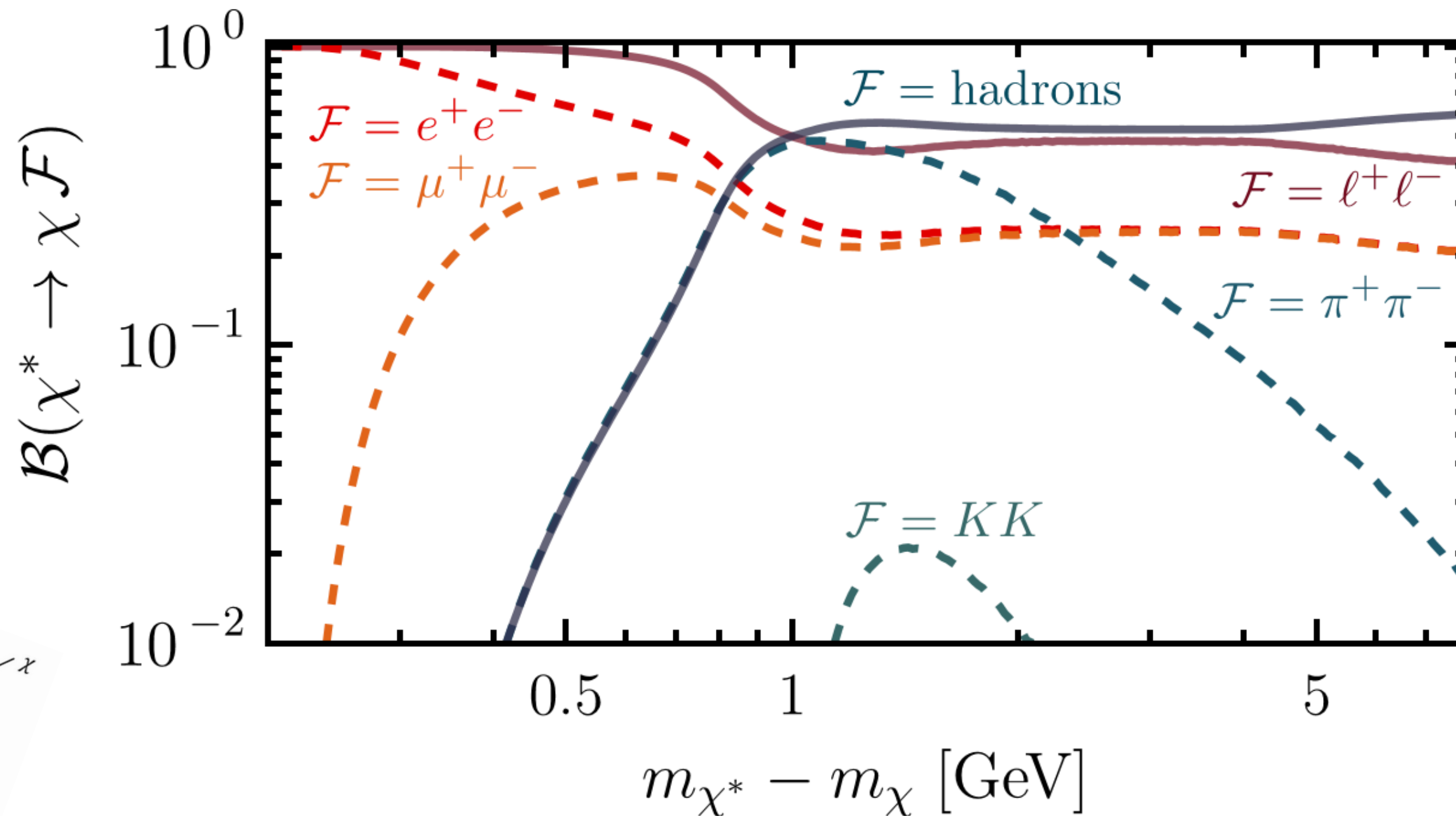
$$\mathcal{L} \supset -\frac{1}{2} \frac{\epsilon}{\cos \theta_w} B_Y^{\mu\nu} A'_{\mu\nu}$$

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niDM - Excited states decays

$$m_{A'} = 3m_\chi$$



branching ratios nearly independent of $m_{A'}$

COLLIDER SEARCHES

