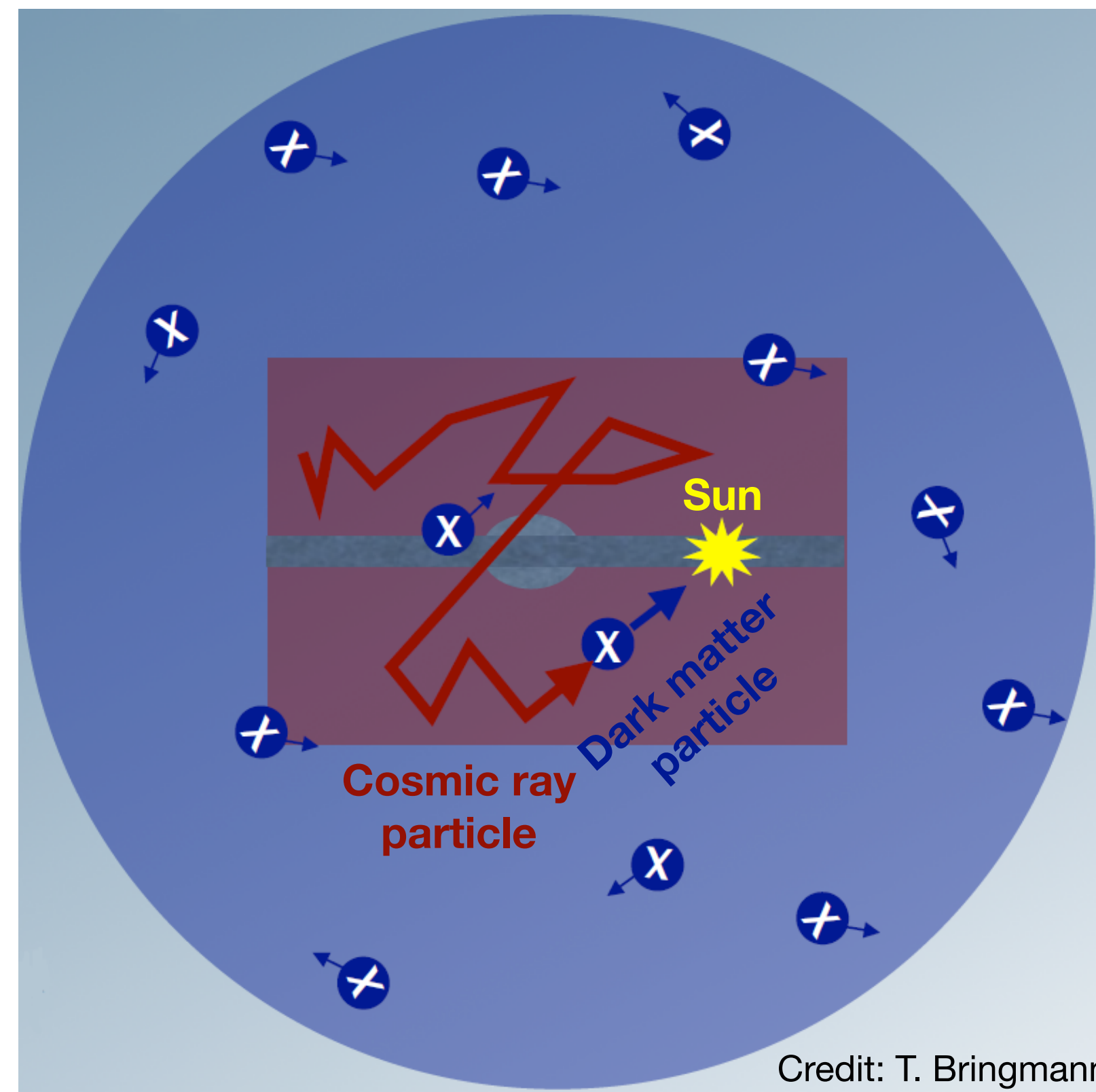


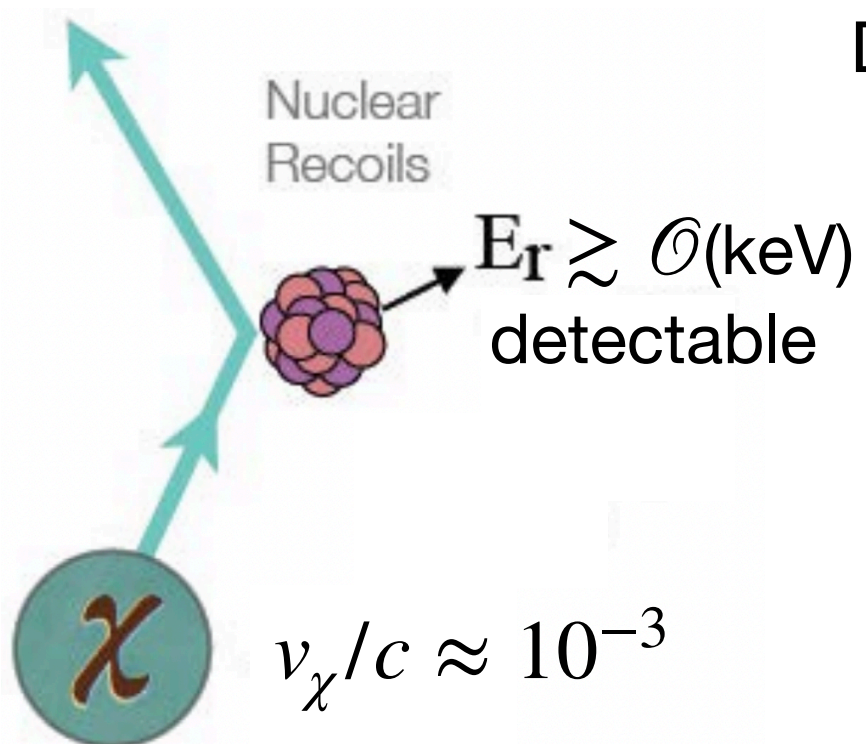
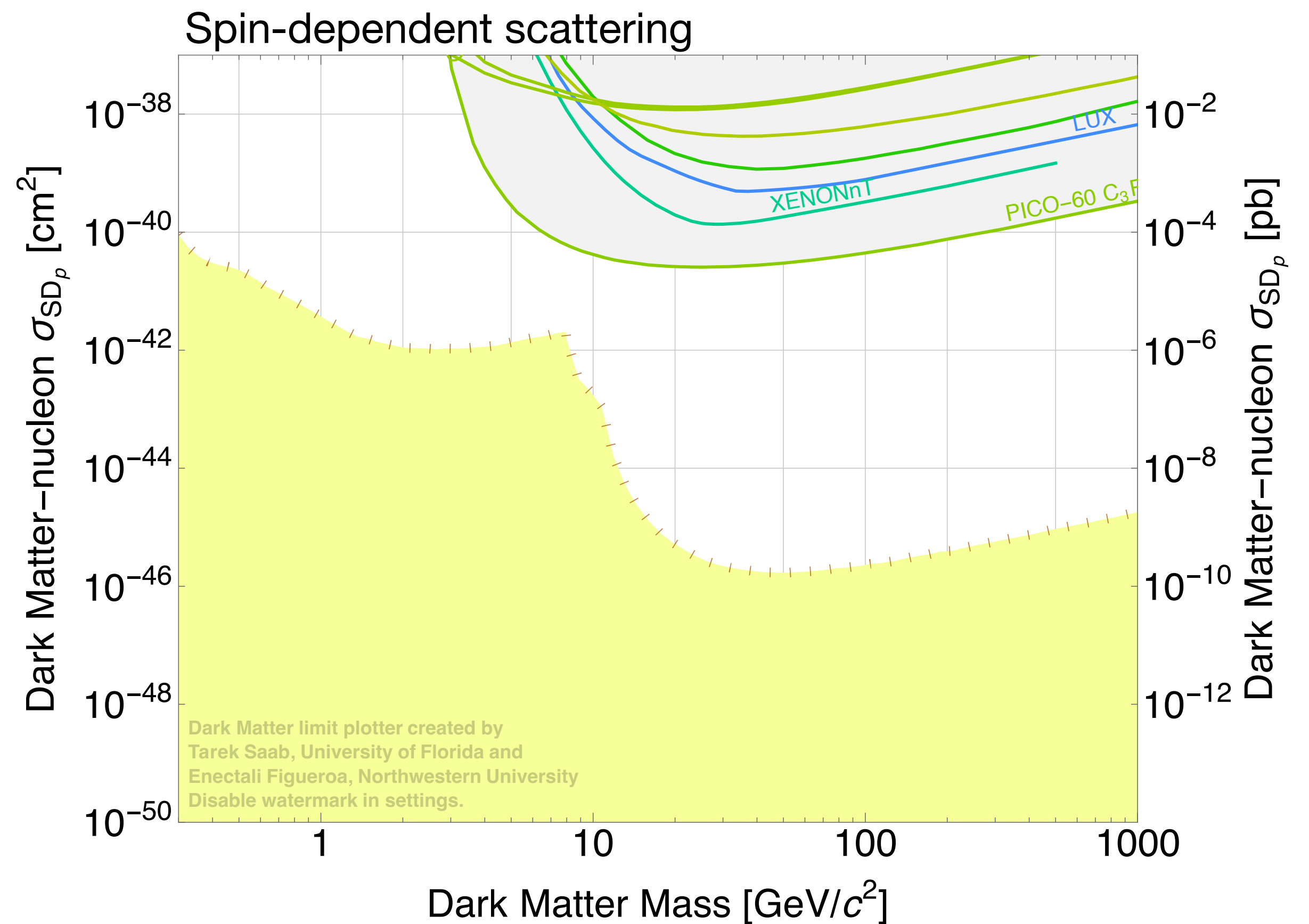
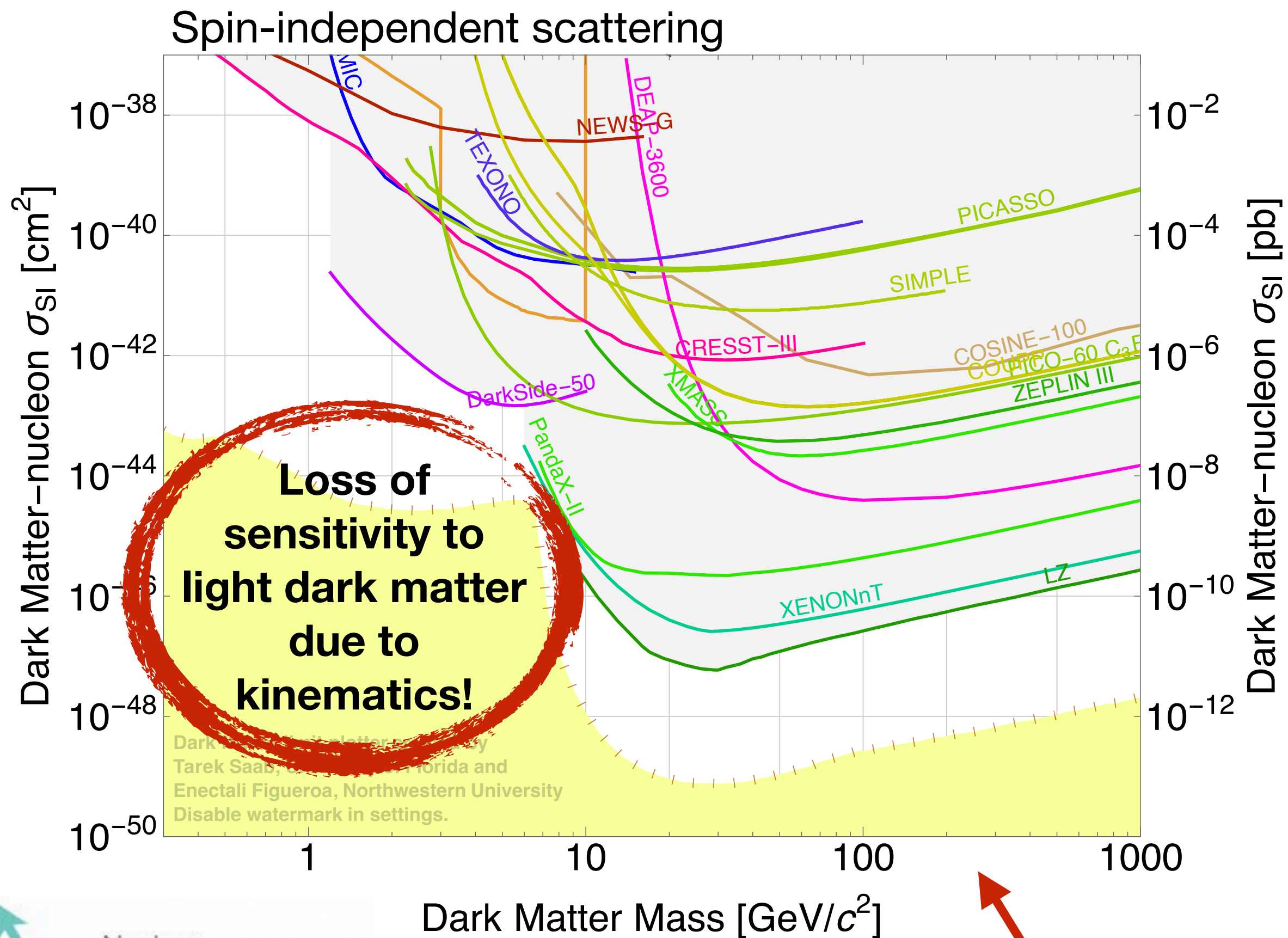
# Interactions of boosted dark matter with nuclei and implications for DUNE

Helena Kolešová (University of Stavanger)



Joint work with James Alvey, Torsten Bringmann and Richie Diurba  
ArXiv: 2209.03360, 2504.16996

# Direct detection of halo dark matter



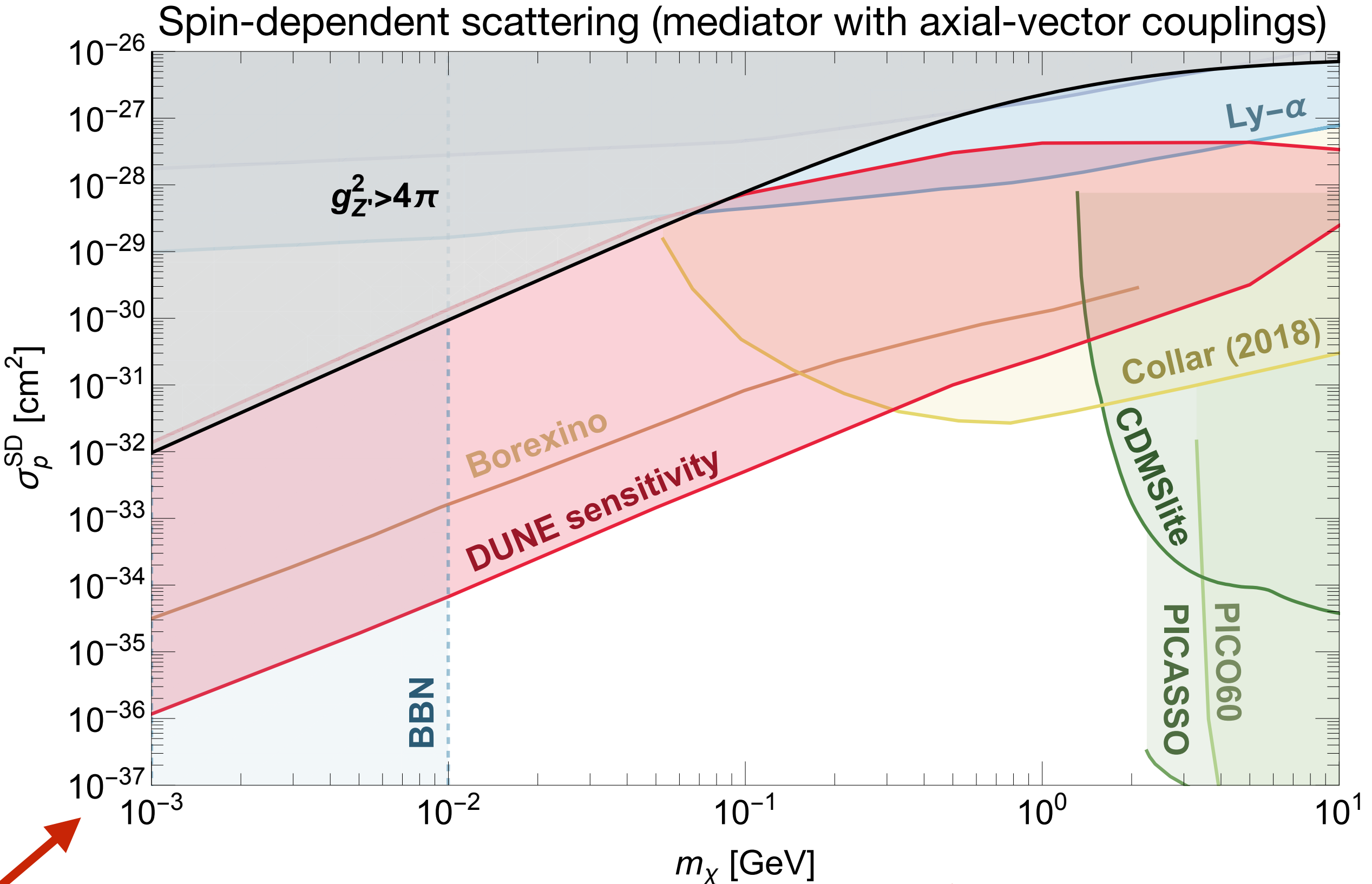
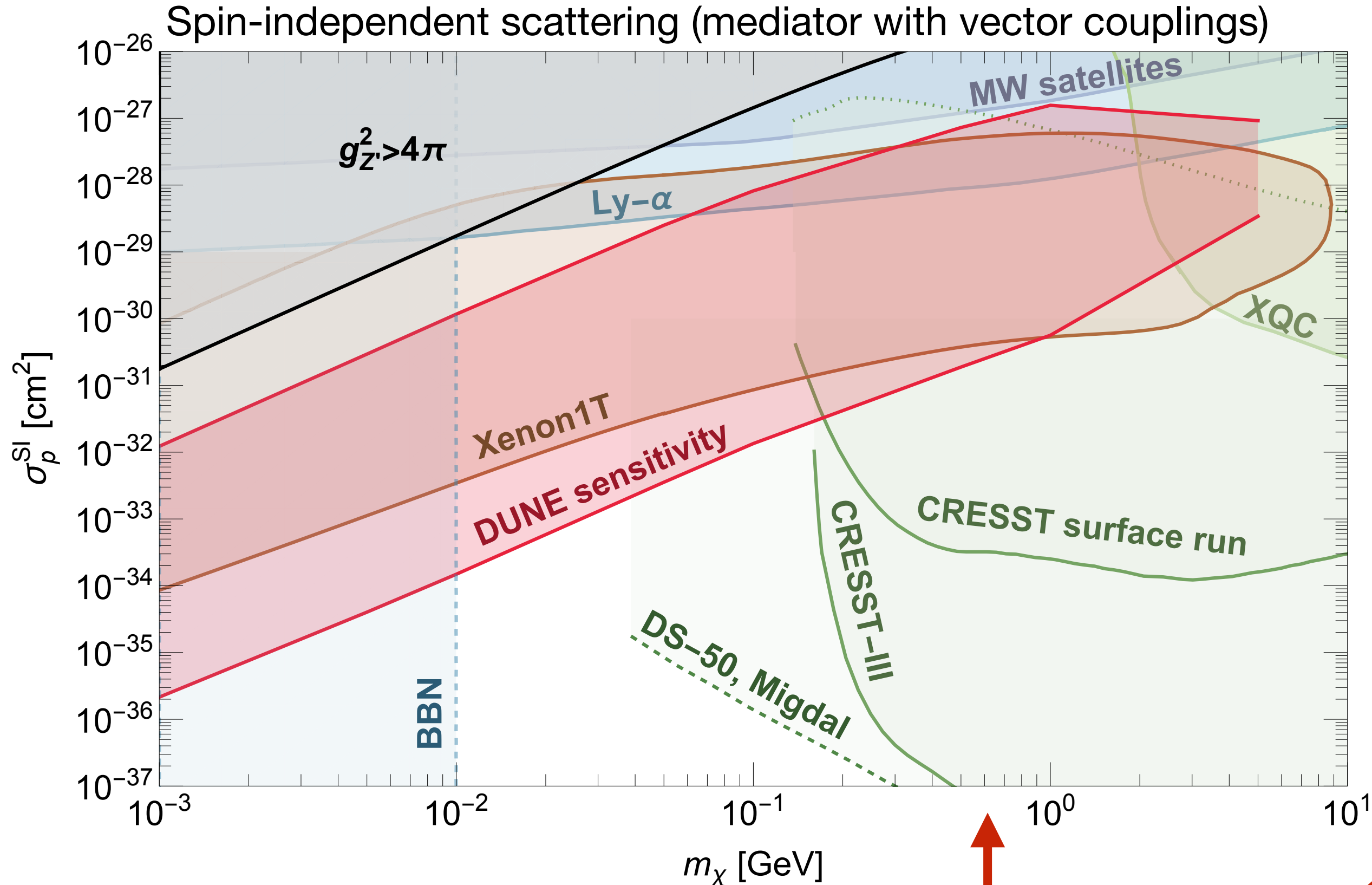
Coherent elastic scattering in spin-independent case:

$$\sigma_{\chi A} \propto A^2 \frac{\mu_{\chi A}^2}{\mu_{\chi p}^2} \sigma_{SI}$$

⇒ strong bounds on  $\sigma_{SI}$  when using heavy nuclei

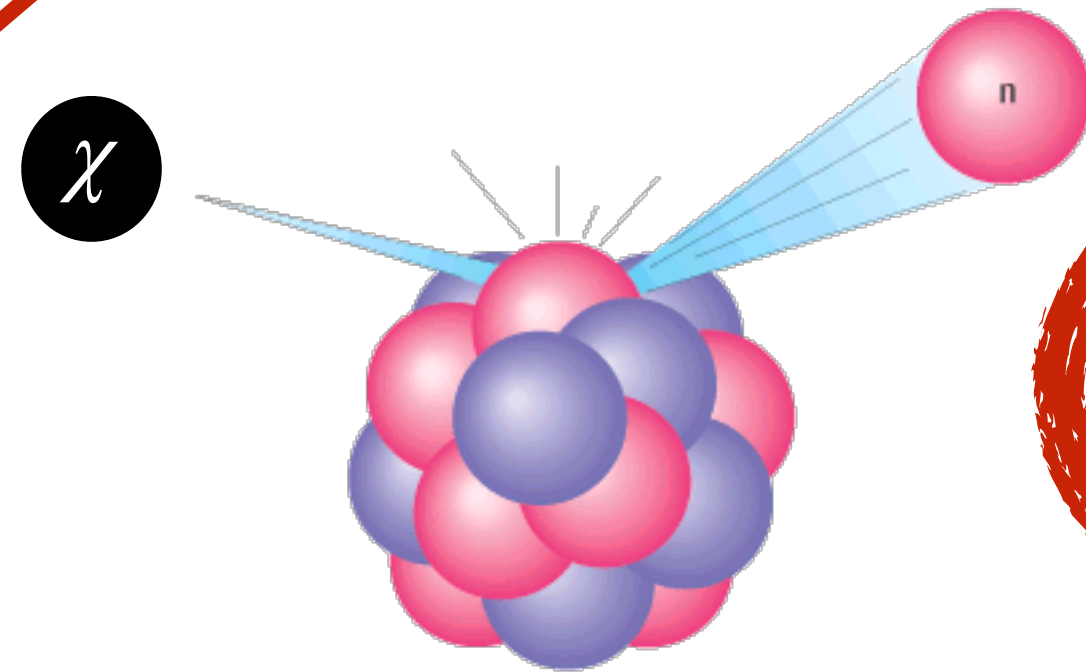
**No enhancement by  $A^2$  for spin-dependent interactions**  
 ⇒ weaker bounds on  $\sigma_{SD}$

# Detection of boosted dark matter in neutrino experiments



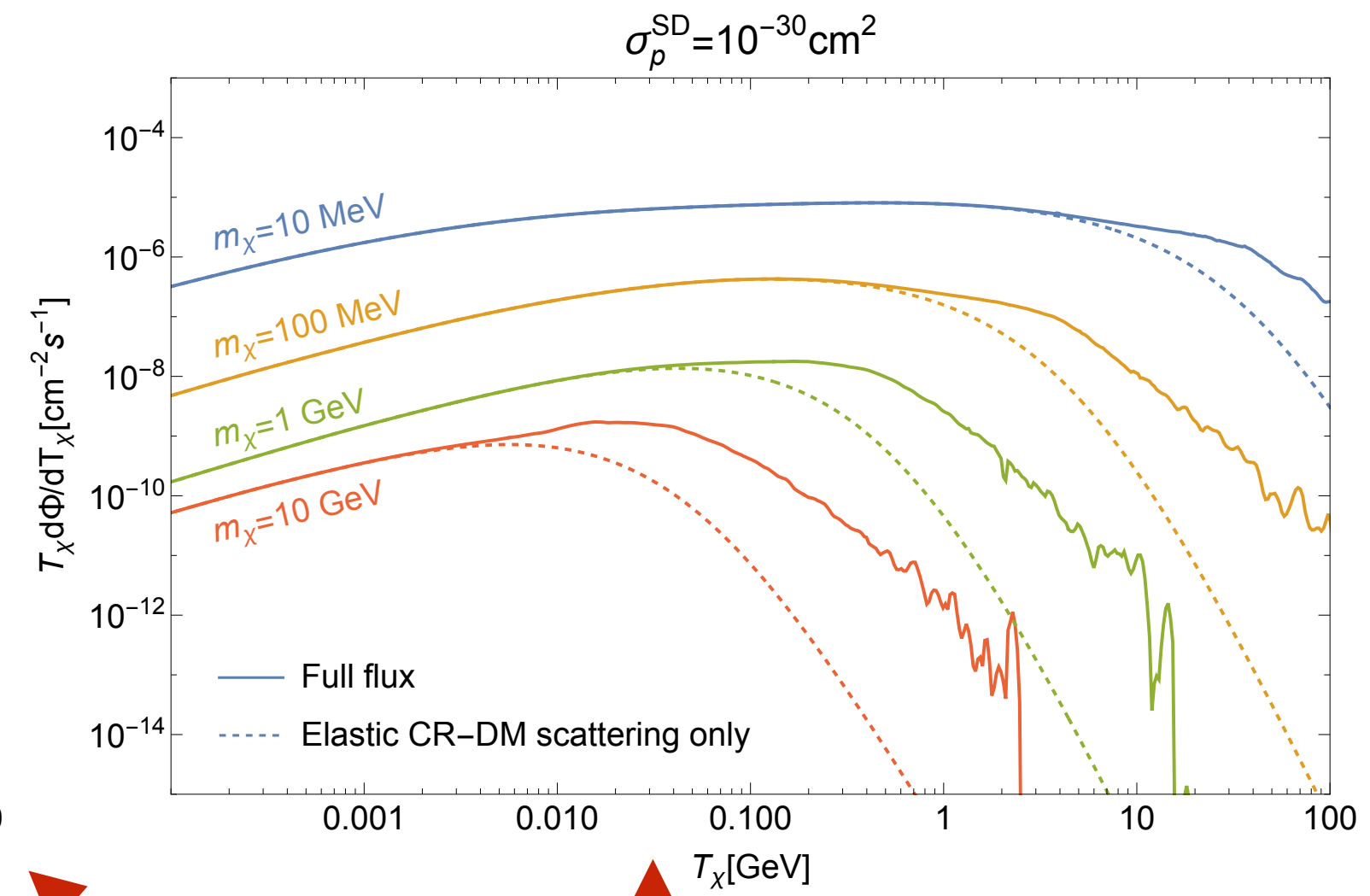
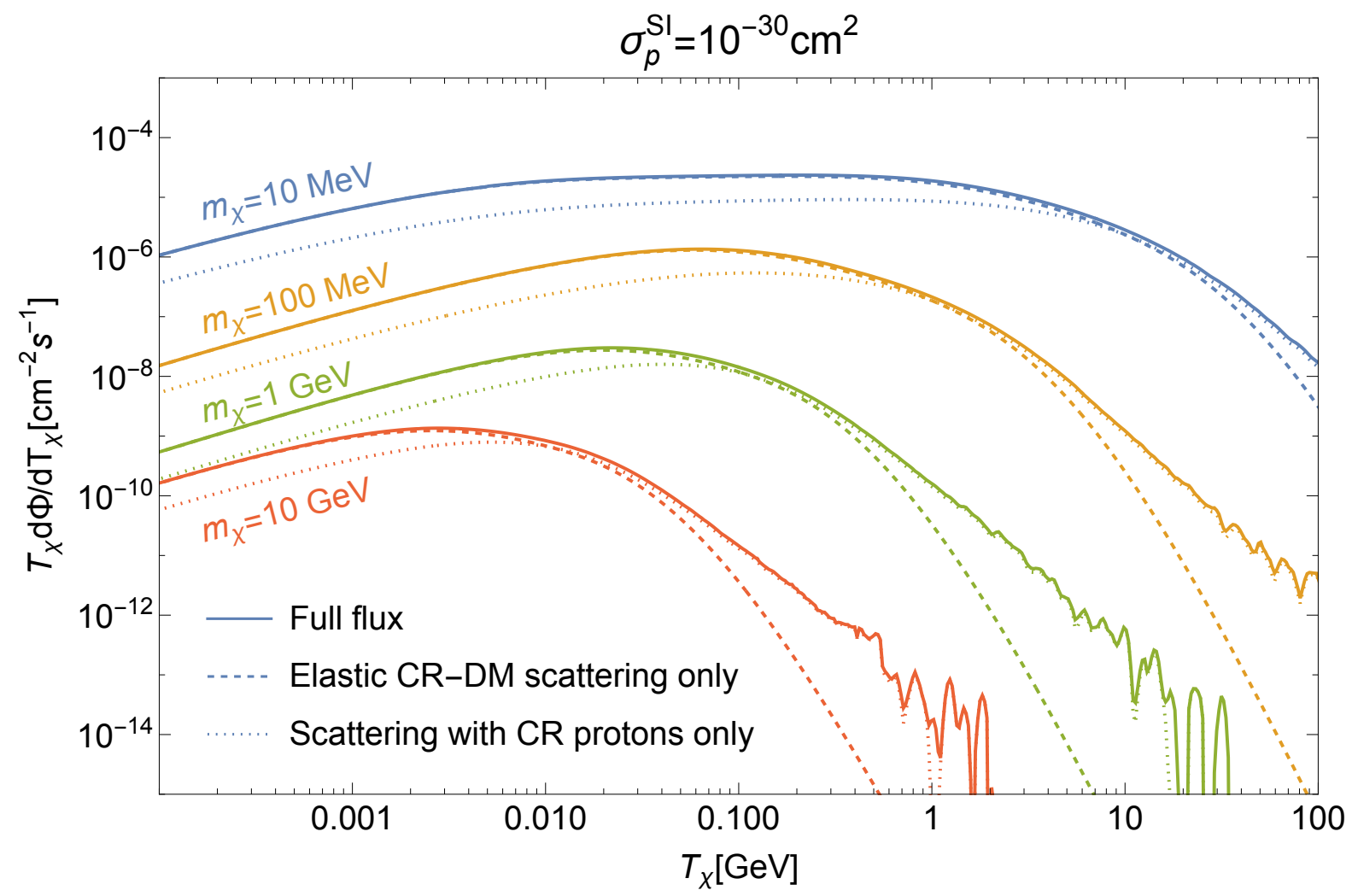
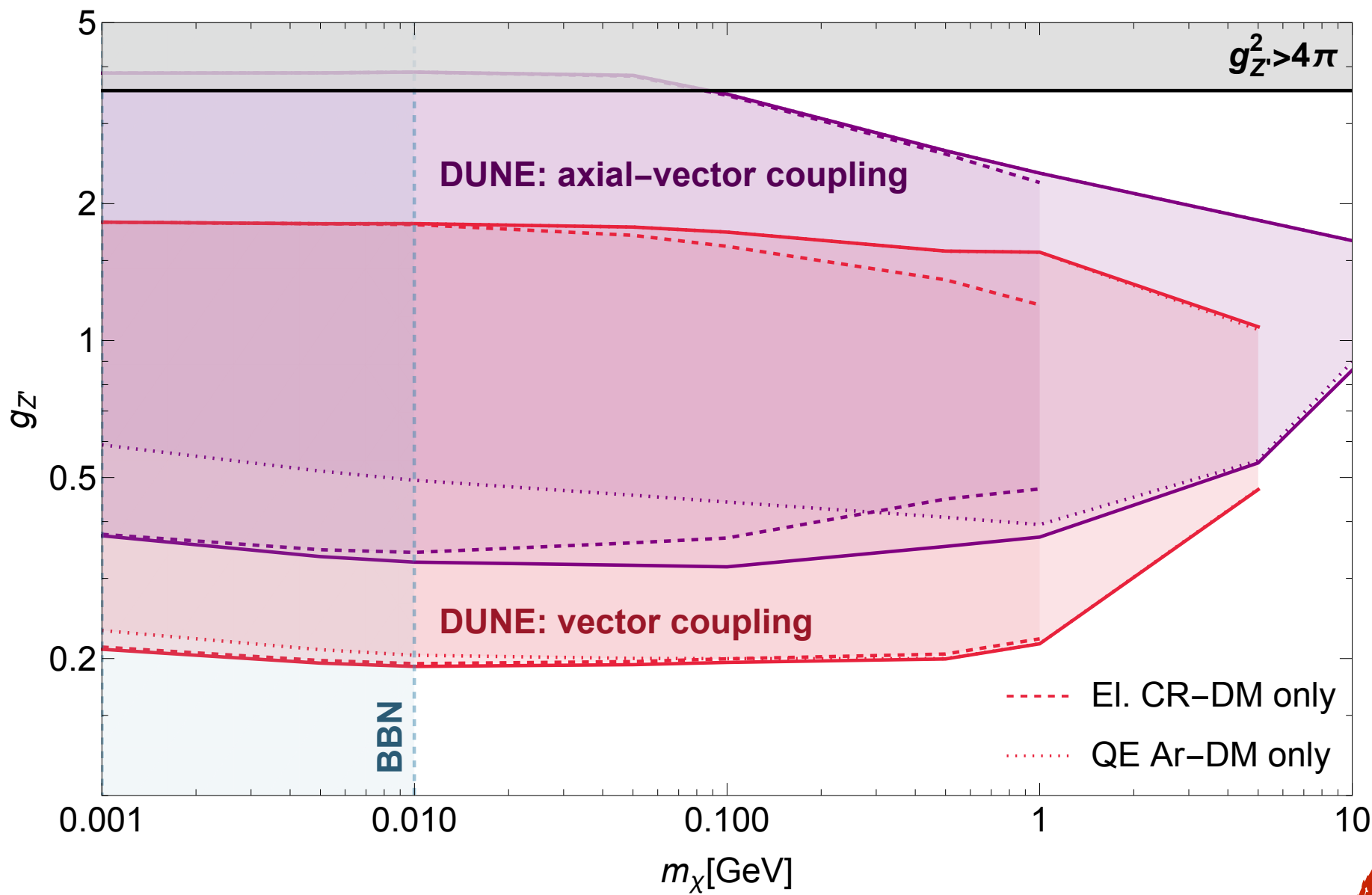
**Sensitivity also to sub-GeV dark matter!**

DUNE sensitivity to cosmic-ray up-scattered dark matter interacting with quarks via a  $Z'$  mediator with (axial-)vector coupling [Diurba, HK: 2504.16996]



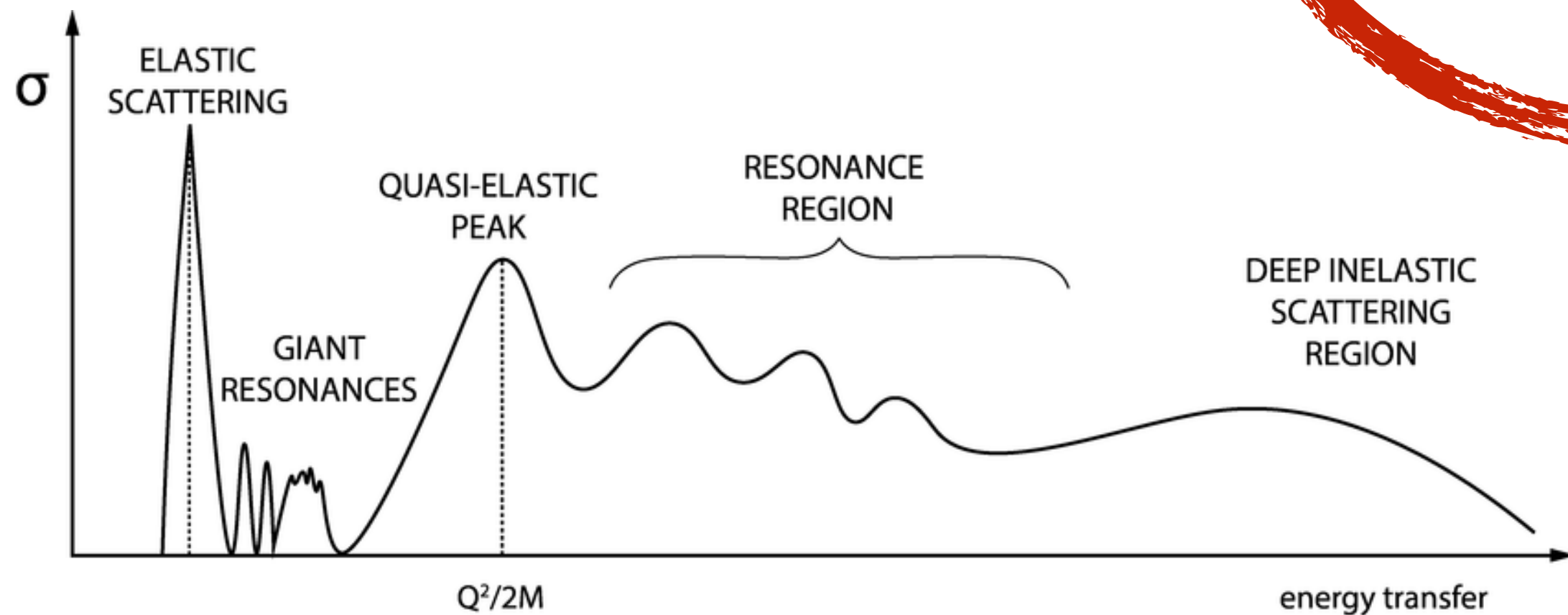
**At higher kinetic energies, dark matter scatters from individual nucleons  $\Rightarrow$  similar sensitivity to spin-independent and -dependent interactions!**

Inclusion of all types of inelastic scattering with nuclei enlarges the DUNE sensitivity region!



Come and talk to me about details :)

Flux of boosted dark matter coming to Earth's atmosphere



Different processes for dark-matter-nucleus scattering  
[image credit: Sobczyk et al.: 10.22323/1.369.0009]

Differential cross sections for dark-matter-argon scattering calculated by the GENIE boosted dark matter module [Berger: 1812.05616]

