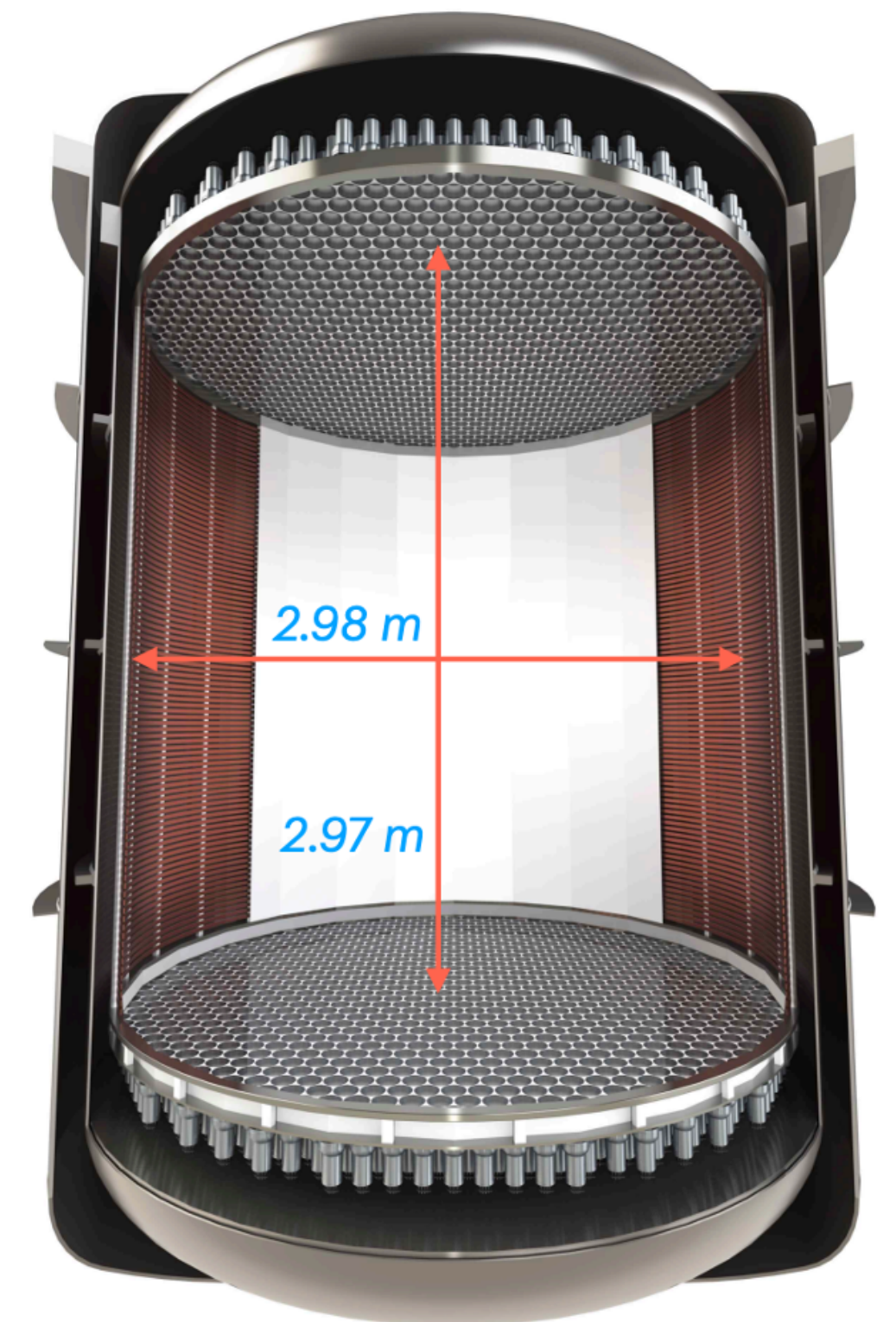


XLZD Sensitivity Projection for new physics

via Low Energy Electron Recoils



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Supervisor: Sally & Alex

Introduction



- These slides present a preliminary study for XLZD on sensitivity to various Low E ER models that have been studied in LZ.
- A set of sensitivity curves (300 T-yr exposures) for the Low E ER models:

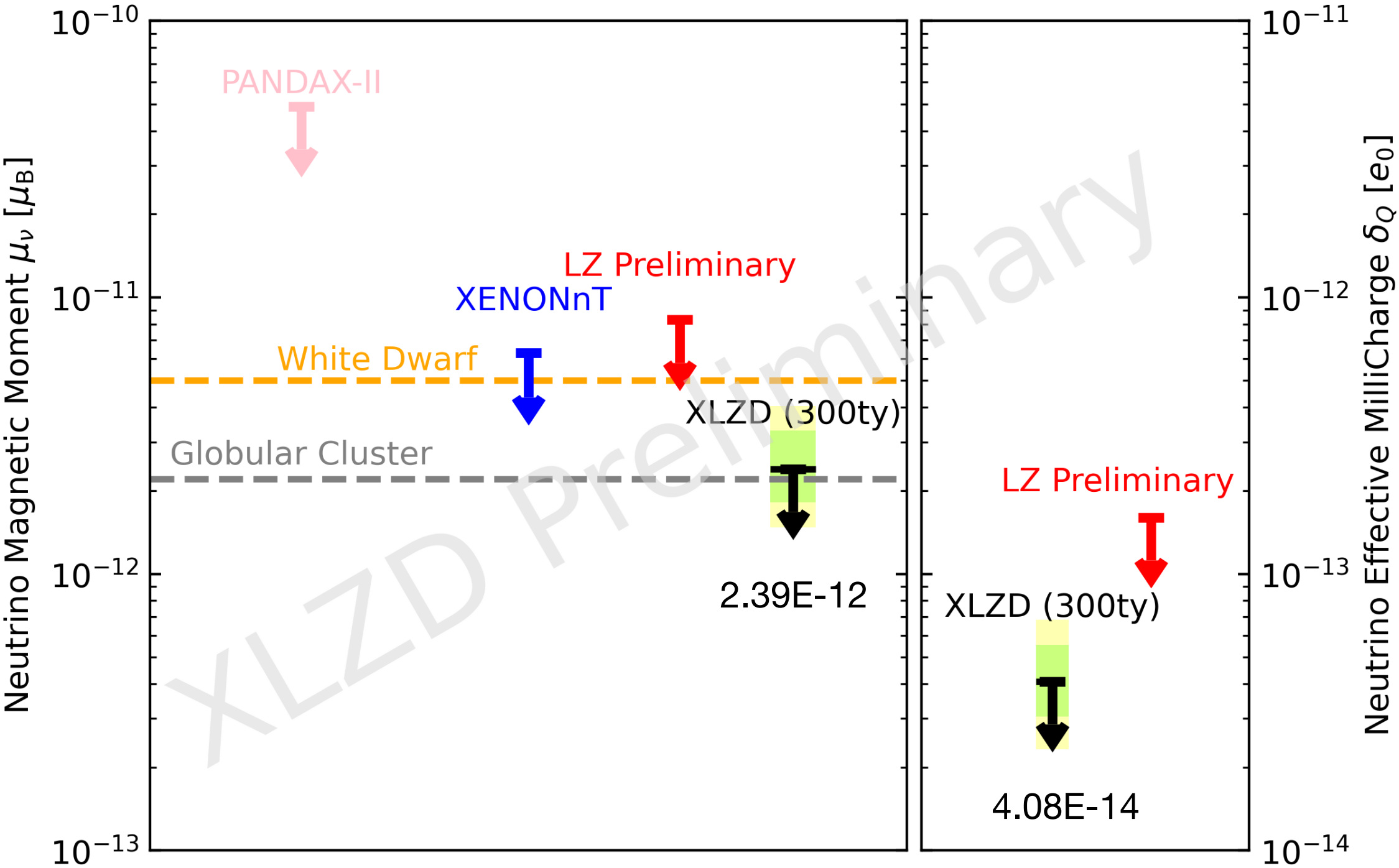
Signal from the sun	Solar Axion	Solar Neutrino
Other Dark matter candidates	Axion-like-Particle & Hidden Photon	Mirror dark matter

- Methodology:
 $(\text{default coupling constant} / \text{projected coupling constant})^n = \text{simulated counts} / \text{projected counts}$
- Statistics — FlameFitSimple with Flamedisx and LZlama using G3 mode.

Solar Neutrino



- Neutrino electromagnetic properties:
magnetic moment and effective milicharge
- Coupling constant μ_ν and δ



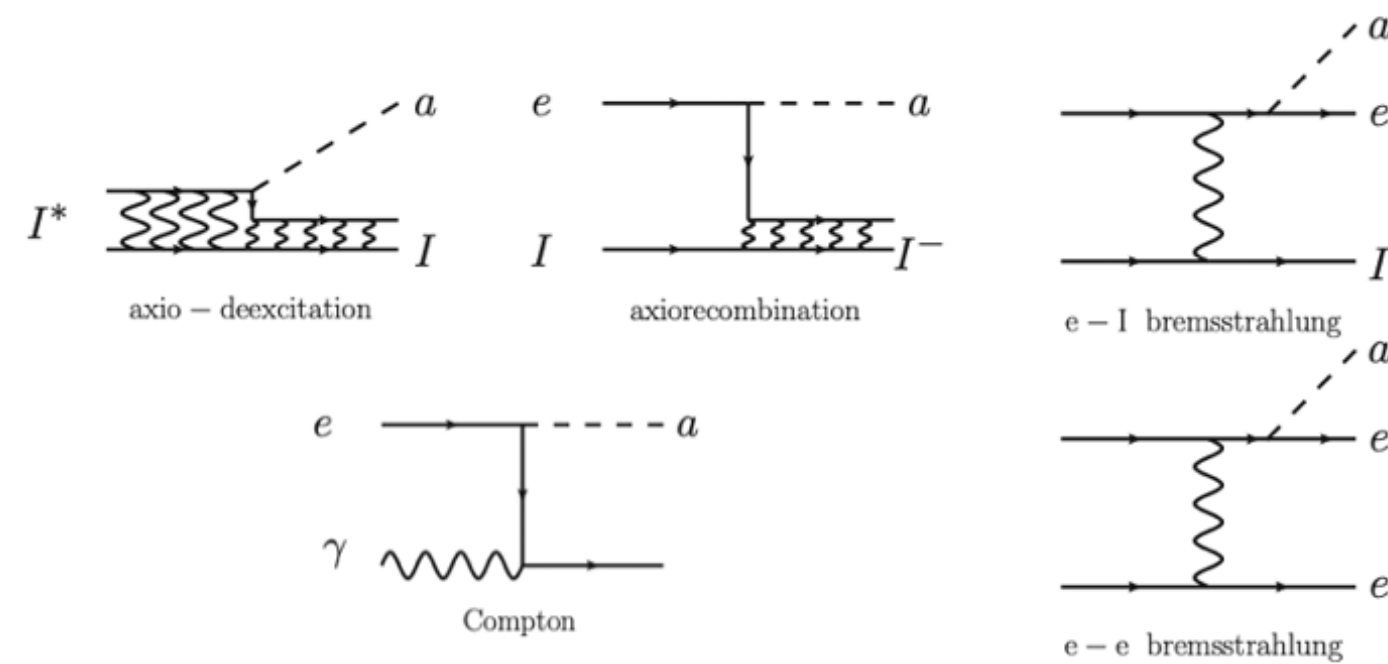
Solar Axion



Solar Axion Flux

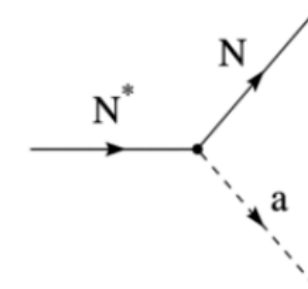
Atomic, Bremsstrahlung and Compton effects

Coupling constant g_{ae}



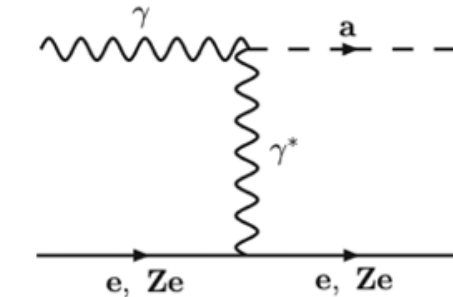
^{57}Fe de-excitation process

Coupling constant g_{aN}



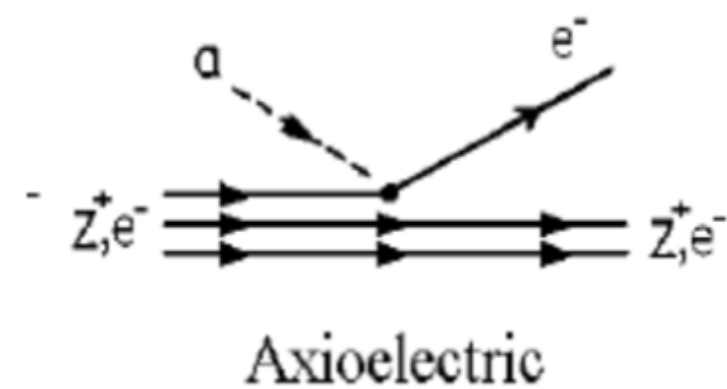
Primakoff effect

Coupling constant $g_{a\gamma}$



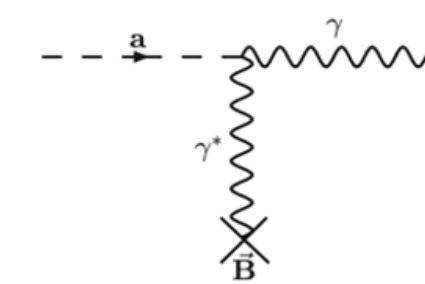
Axioelectric coupling

Coupling constant g_{ae}



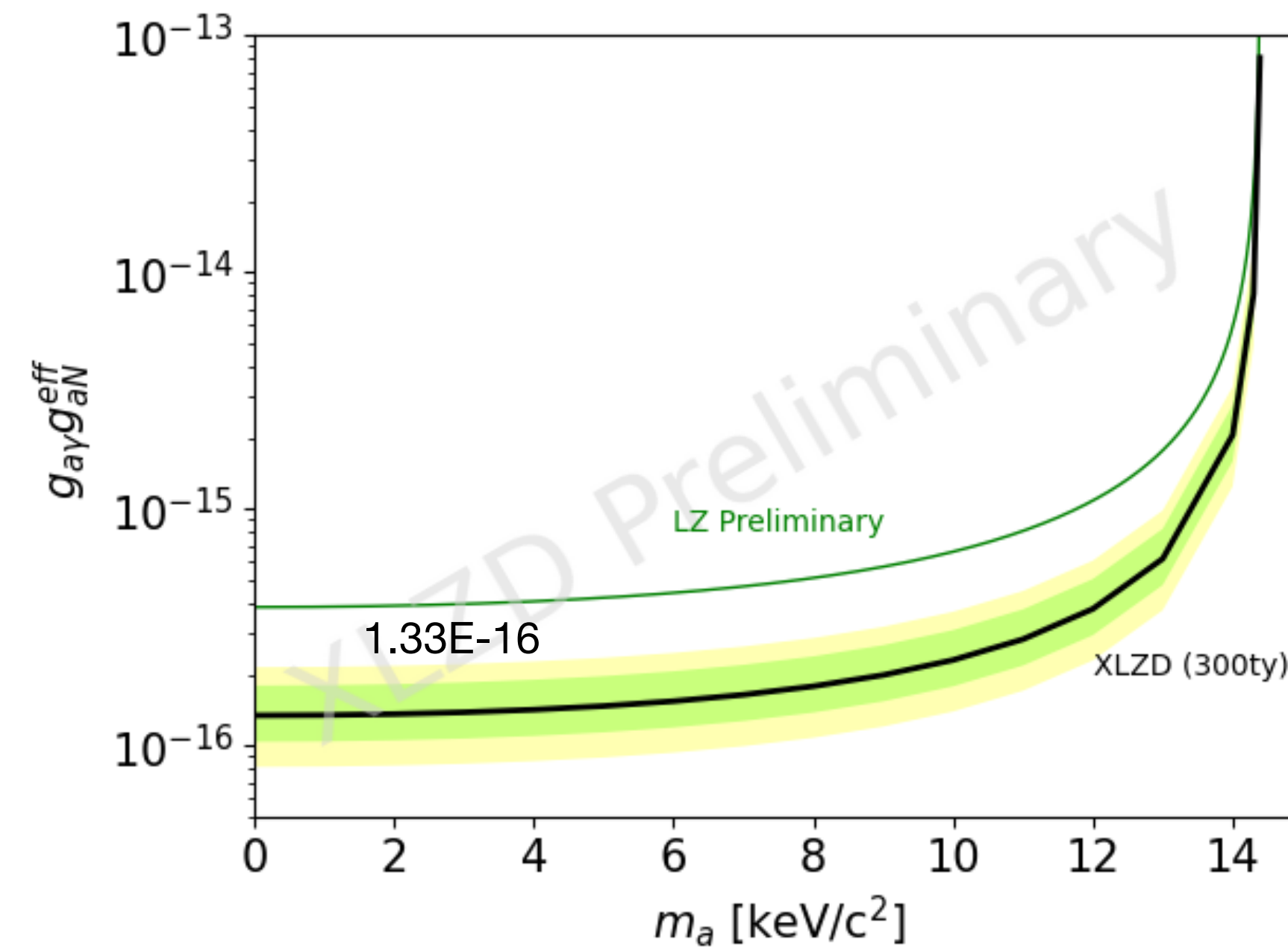
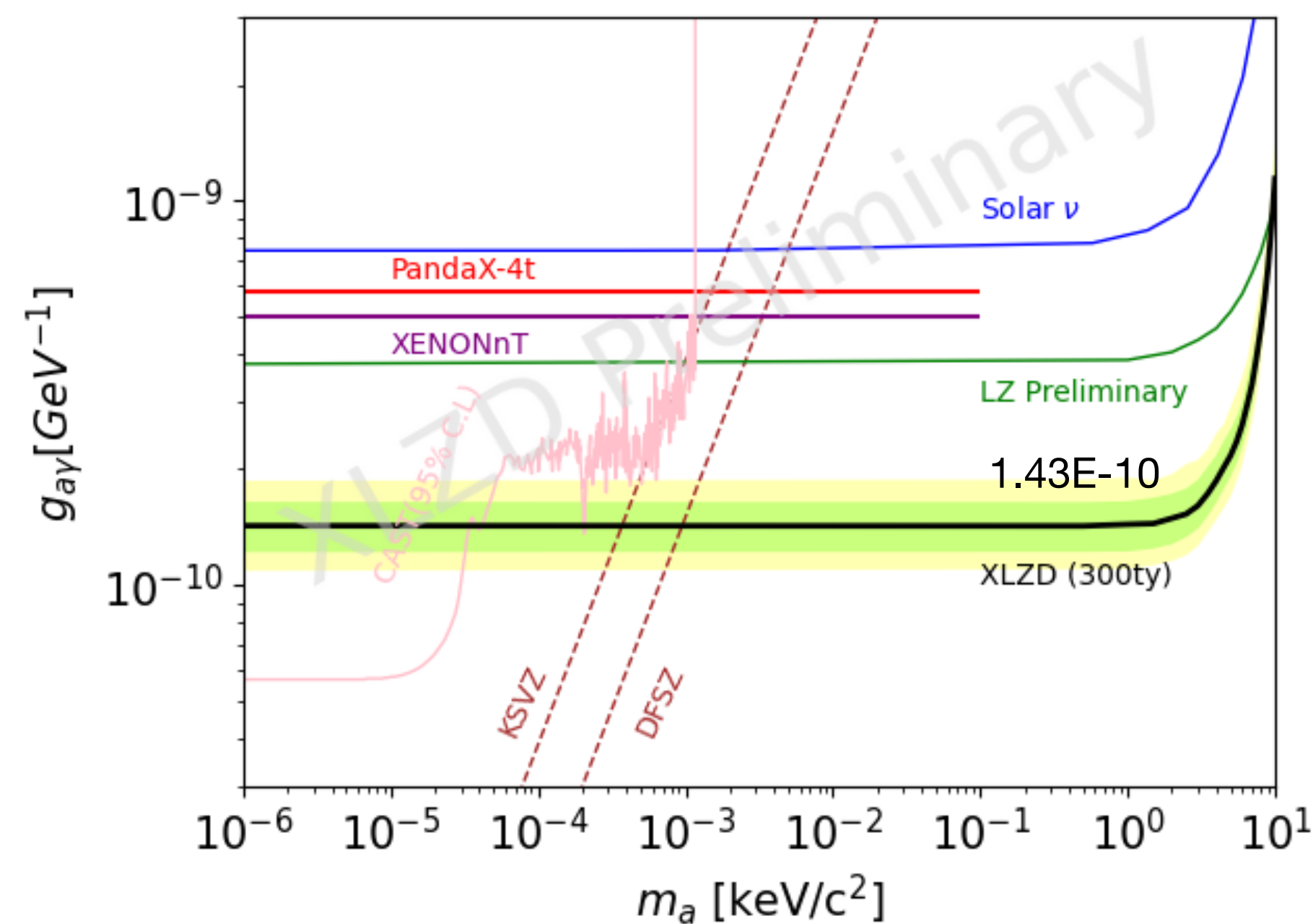
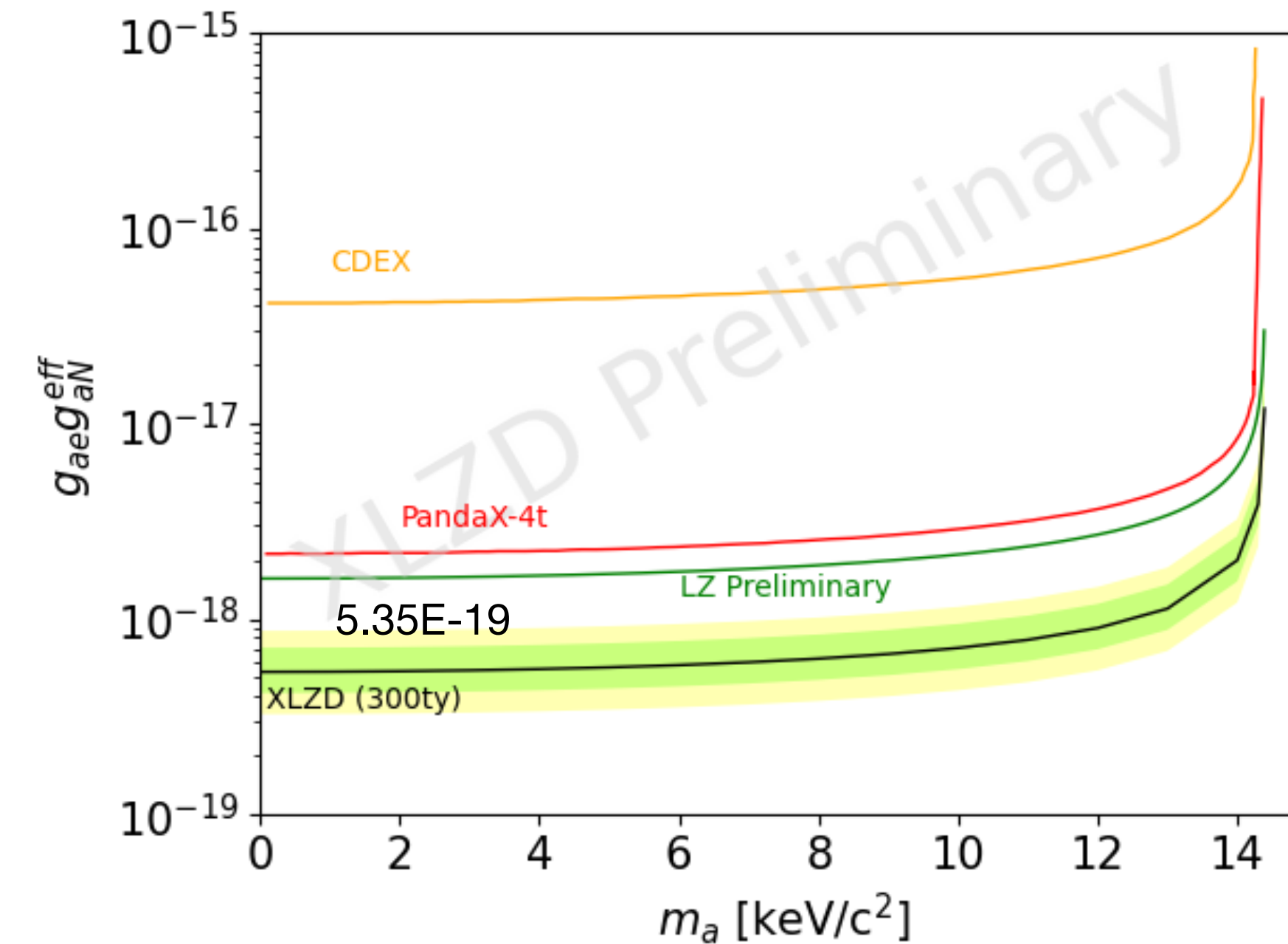
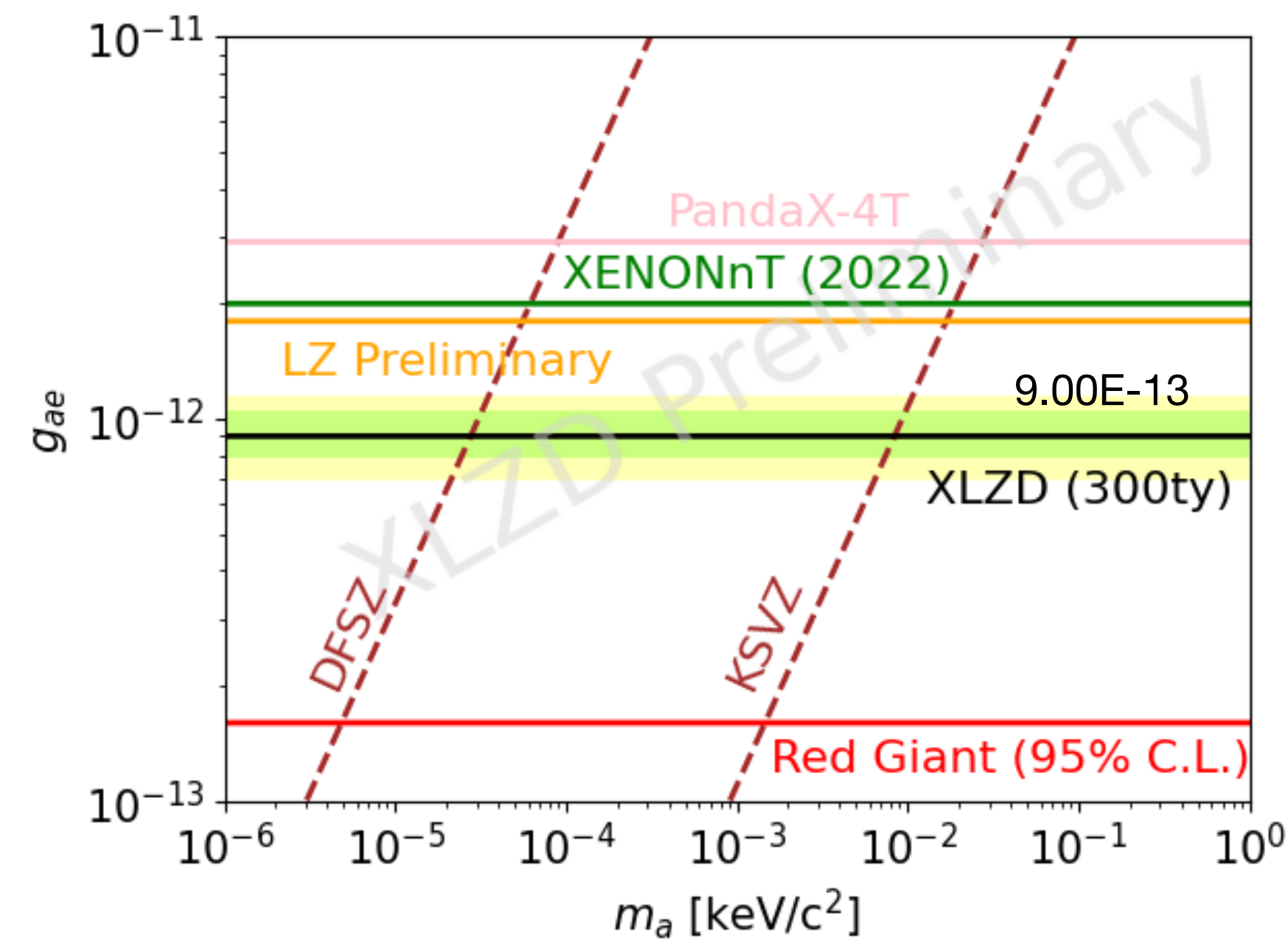
Inverse Primakoff process

Coupling constant $g_{a\gamma}$

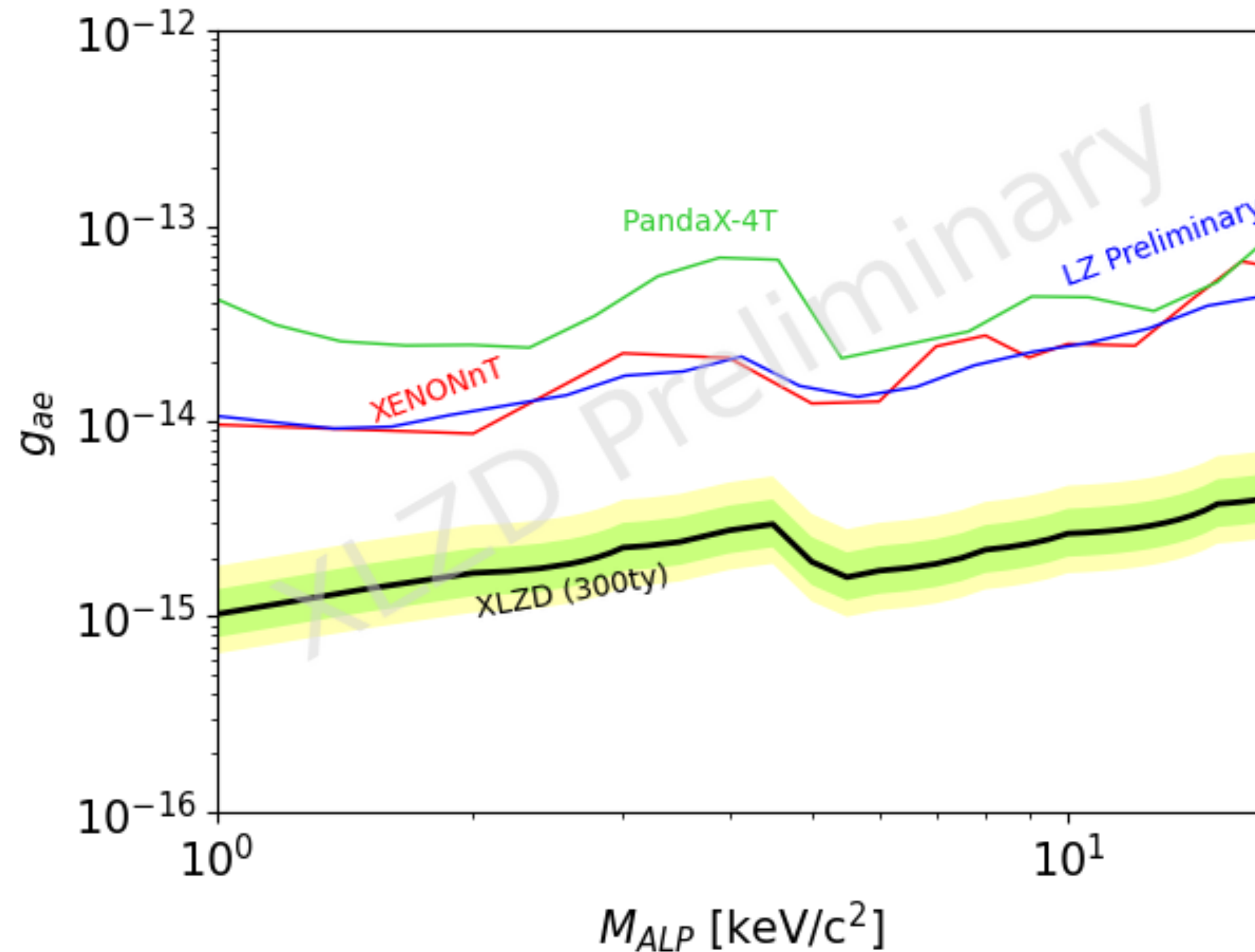


Detection in TPC

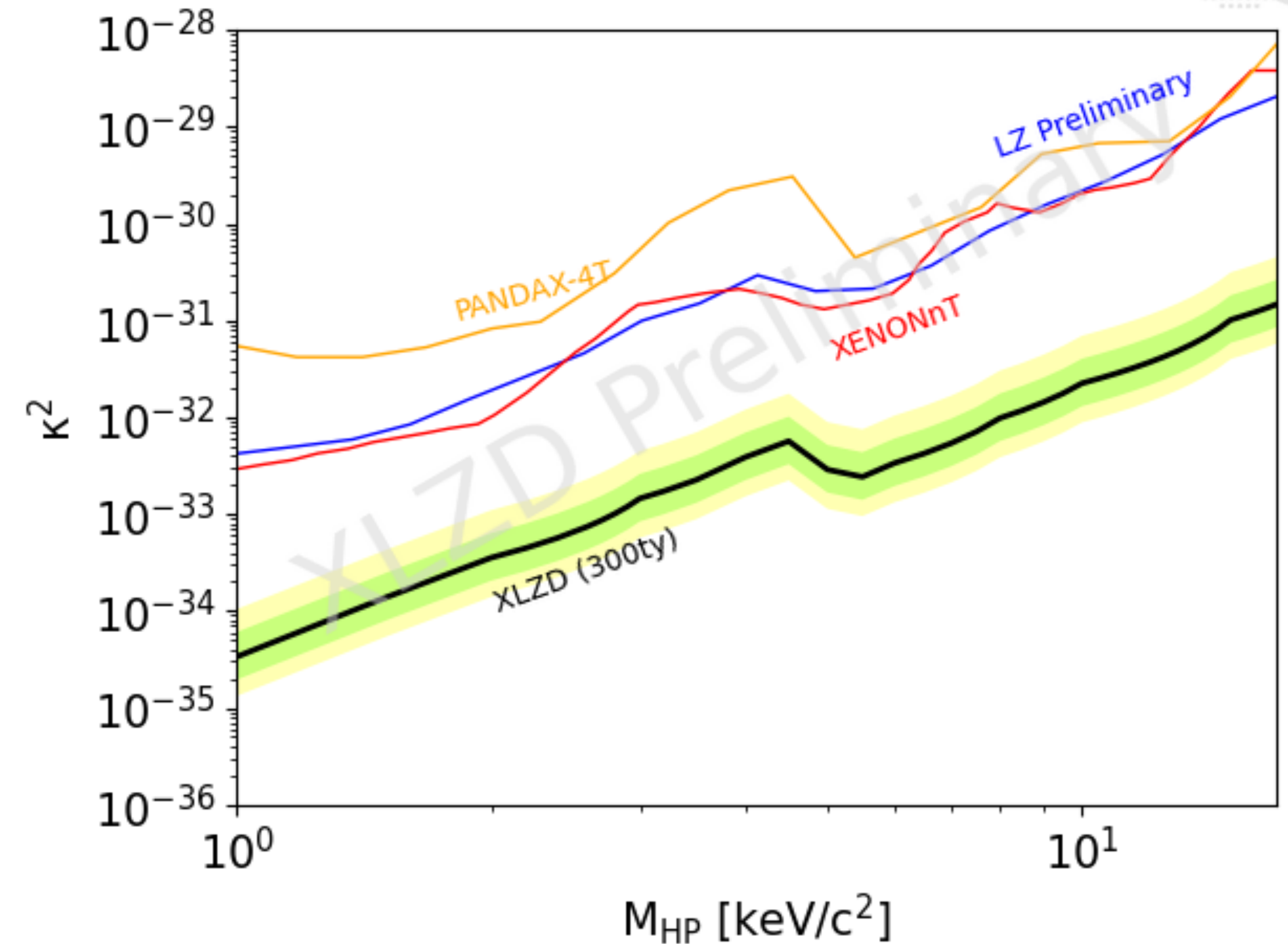
Solar Axion



Axion-Like-Particle g_{ae} & Hidden Photon κ^2



Since ALPs' relic abundance in the universe could contribute to the dark matter density, ALP is defined as a "cold" dark matter component that remains distributed across the cosmos.

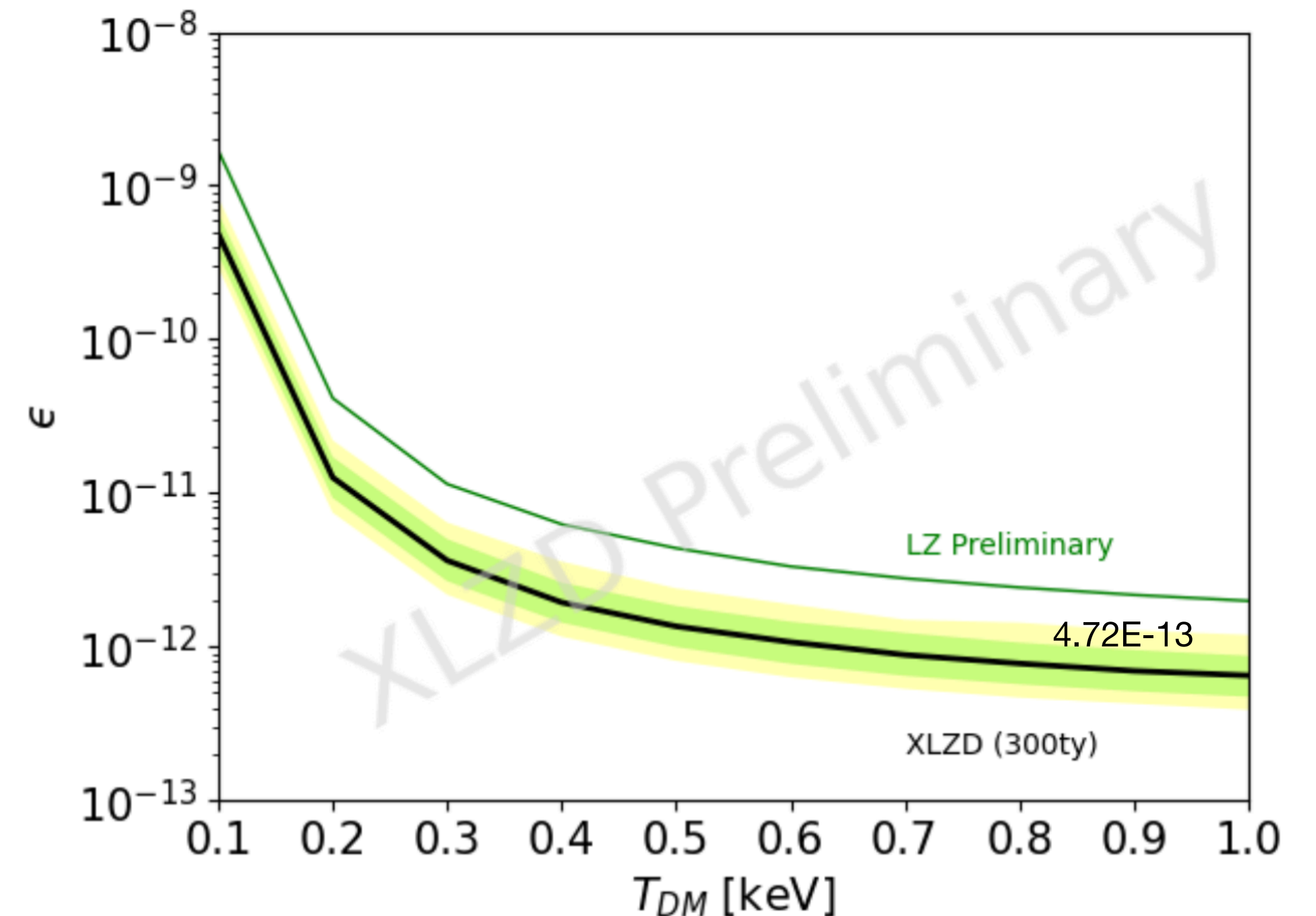


Hidden photon is an extra $U'(1)$ gauge boson

Mirror Dark Matter



- Hidden sector is proposed to mirror standard model but with reversed space-time parity.
- Some mirrored particles in this hidden sector, because of broken symmetry, could be dark matter
- Mirror dark matter interact with standard model particles, with kinetic mixing constant ϵ



Summery



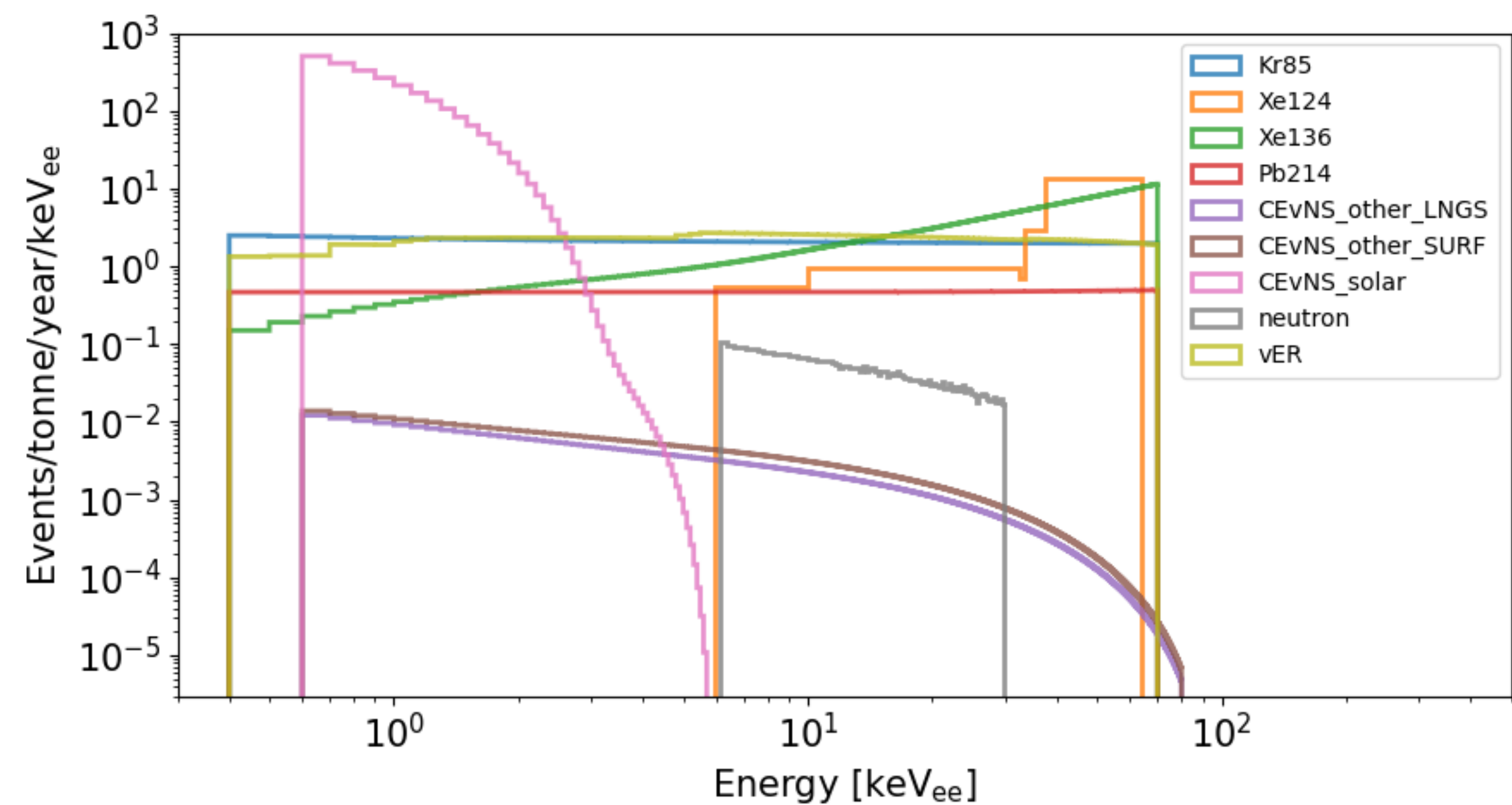
- XLZD Preliminary sensitivity have been produced for low E ER models with 300 T-yr exposures.
- LZlama G3 is useful for XLZD low E ER simulation, but plan to update DMcalc with more signal models for future XLZD analysis.

Appendix

Backgrounds



- WIMPs BKGs
- Low E ER models BKGs



Component	Spectrum
Pb214	Normalisation: 2007.13686 Shape: taken from LZ simulations
Kr85	Normalisation: $T_{1/2} = 10.76$ yr; 2×10^{-11} isotopic abundance; 99.6% ground-state branching ratio Shape: taken from LZ simulations
Xe136 2vBB	Normalisation: 1306.6106 Shape: taken from LZ simulation
Xe124 2vDEC	Normalisation: 2205.04158 Shape: taken from LZ simulation
Solar neutrino ERs (PP + 7Be + CNO)	From DMCalc (LZ)
CEvNS (B8 + hep)	From DMCalc (LZ)
CEvNS (atmospheric + DSNB)	From DMCalc (LZ)
Neutrons	From GEANT4 simulations (Sally Shaw et al.)

Robert: *XLZD WIMP search performance studies*