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Boosting the production of sterile neutrino dark matter with self-interactions

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In collaboration with:
Stefan Vogl
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Sterile neutrinos as dark matter

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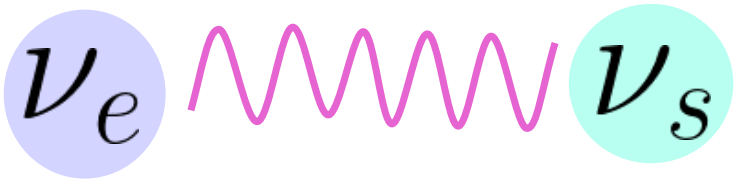
↳ keV sterile neutrinos are good DM candidates

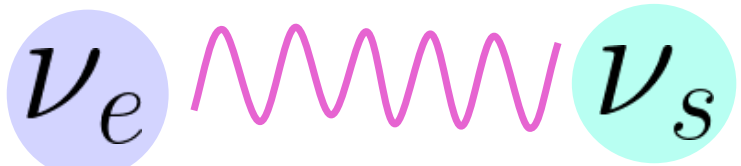
Sterile neutrinos as dark matter



The Dodelson-Widrow (DW) scenario

- SN are produced in the early universe through oscillations

Sterile neutrinos as dark matter



Can be searched for by current and future X-ray telescopes

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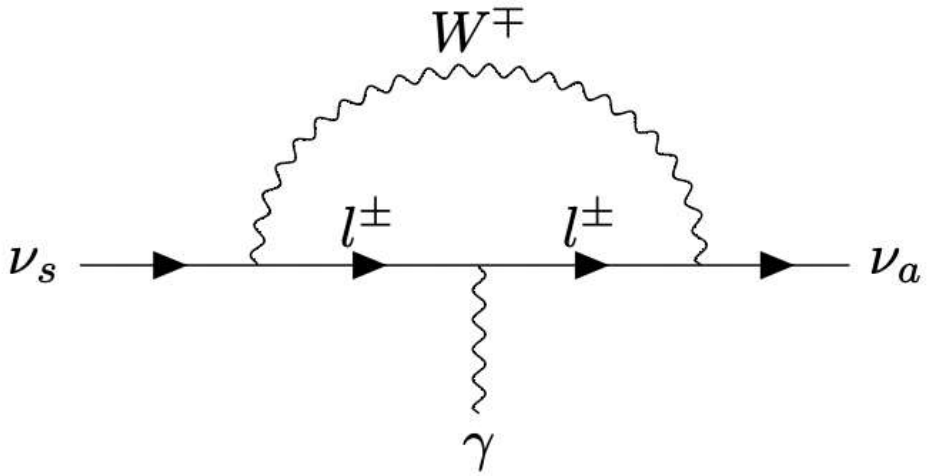
- The mixing with the SM also allows for late decay into an X-ray photon



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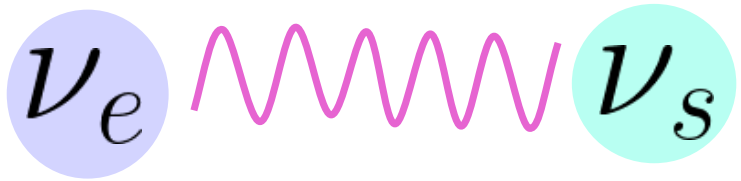

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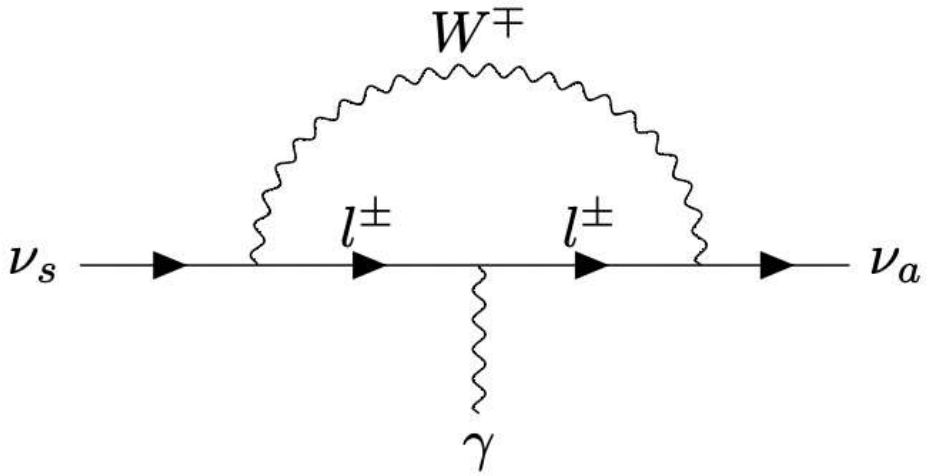

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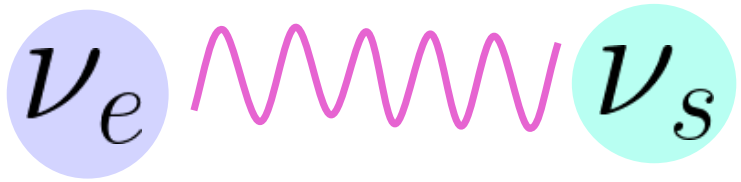

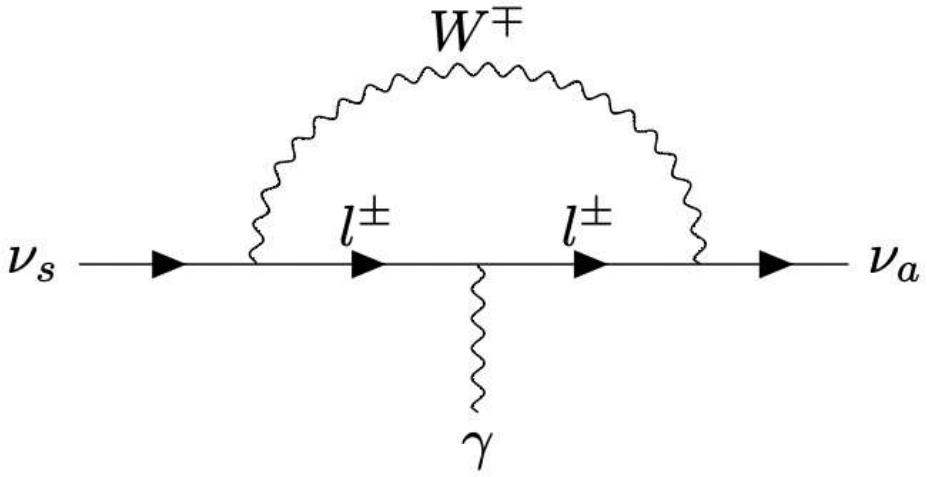

$$\mathcal{L}_{\rm int} = y\ \bar{\nu}_s \nu_s \phi.$$

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How to extend DW?

↳ Self-interactions

Self-interacting sterile neutrinos

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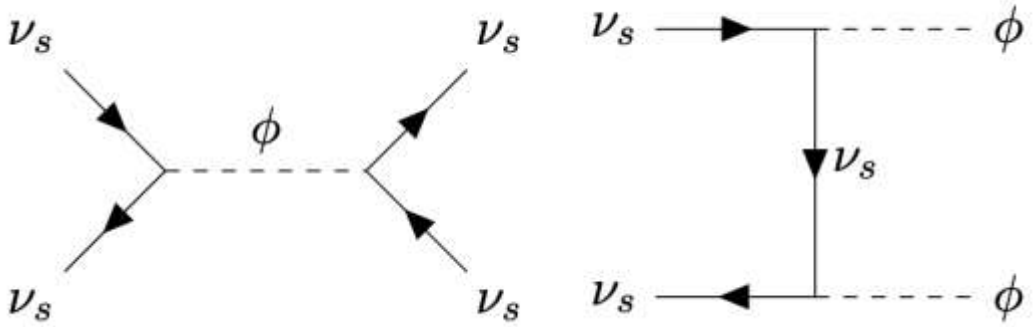
1. New scattering rate

$$\Gamma_t = \Gamma_a + \Gamma_s$$



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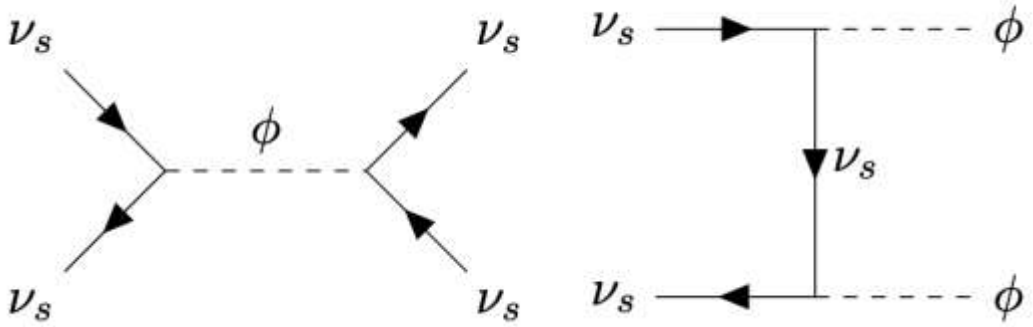
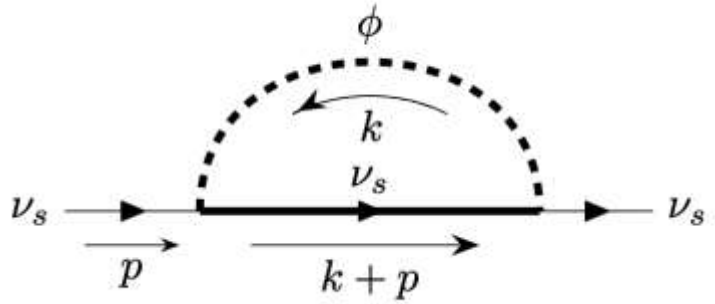
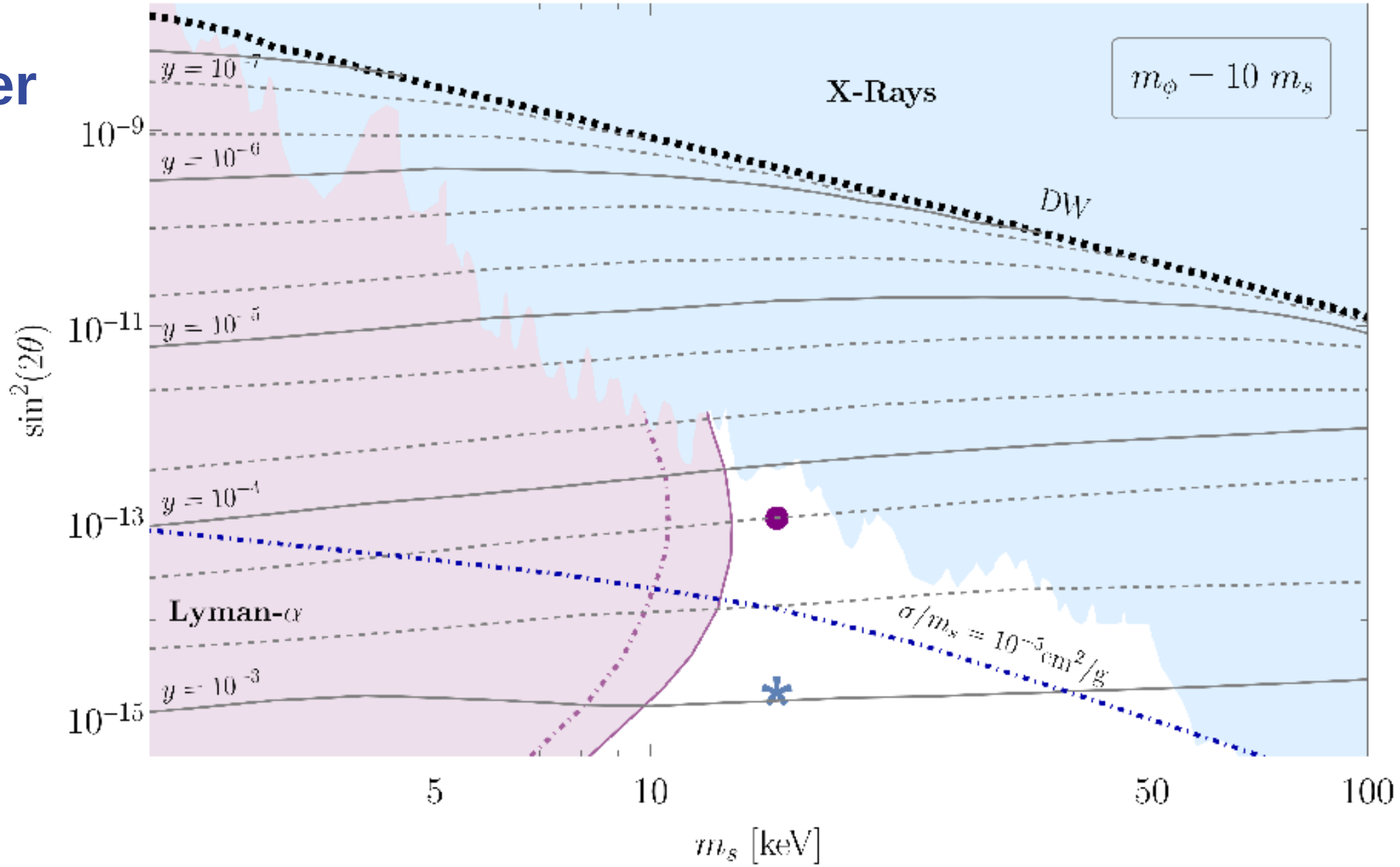


2. Correction to the neutrino's self energy

$$V_{\text{eff}} = V_a - V_s$$



The parameter space



Conclusions

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- The canonical DW mechanism is mostly excluded
- Self-interactions among the sterile neutrinos can open new portions of parameter space

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Thank you for your attention