Relic neutrino Background from Cosmic-Ray Reservoirs

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Based on: AGDM, Granelli, Nava, Sala [2405.04568]

ν upscattering: a cartoon

- Non-relativistic νs hanging around

ν upscattering: a cartoon

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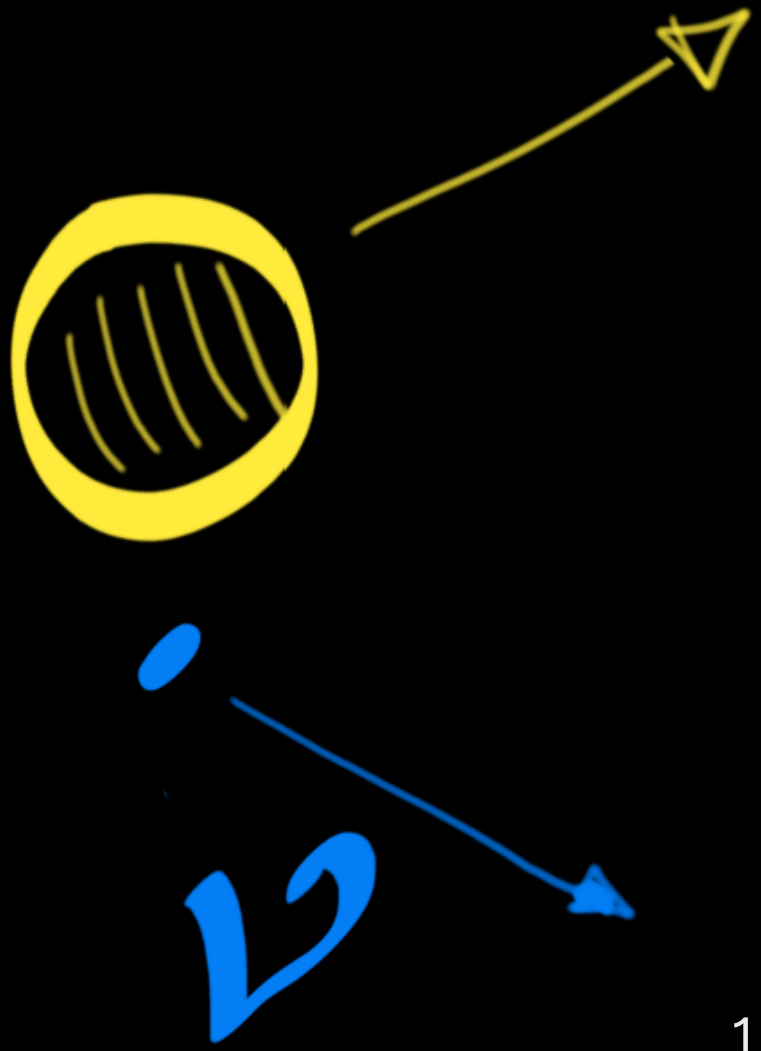
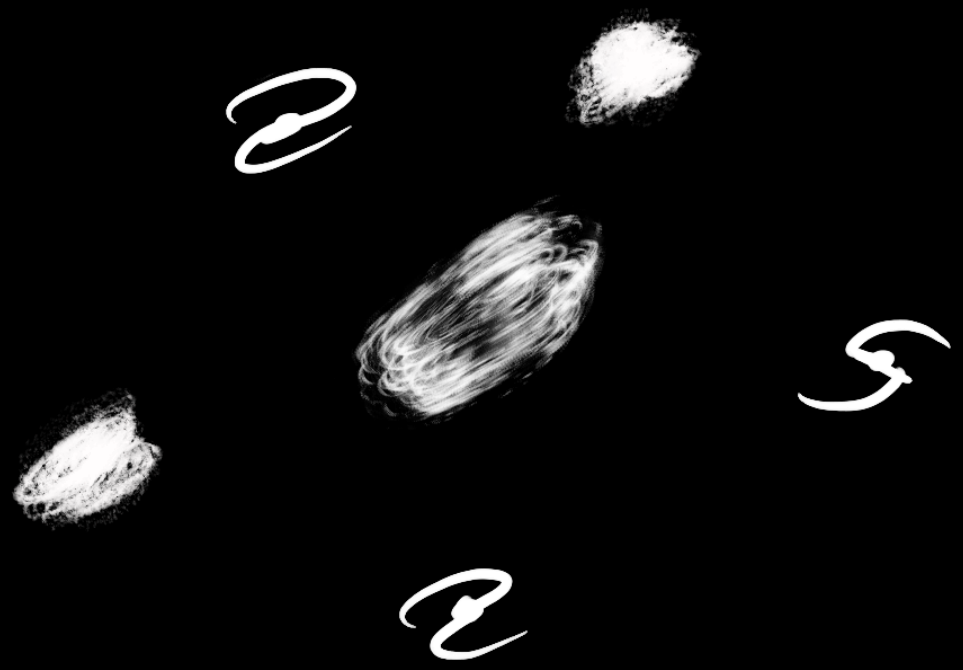
- UHECRs pass through the RνB

ν upscattering: a cartoon



- Non-relativistic νs hanging around
- UHECRs passes through the RνB
- Can upscatter νs to UHE!

Let’s look at the (possible) source



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Fang, Murase (2017, Nature Phys.) 1704.00015:

- Look at galaxy clusters

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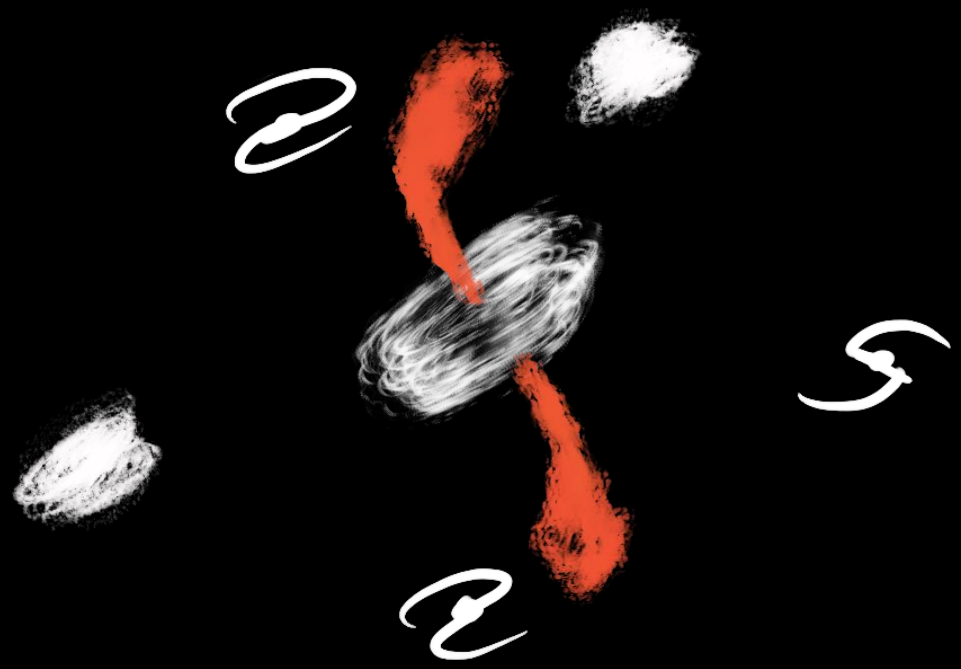

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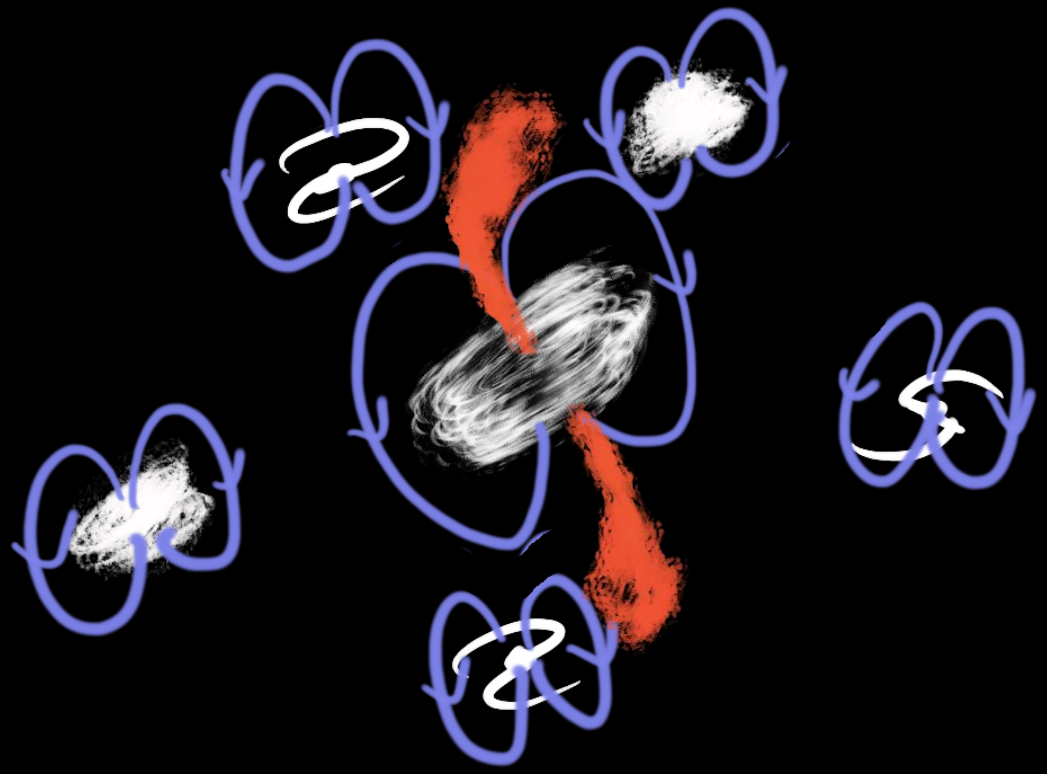

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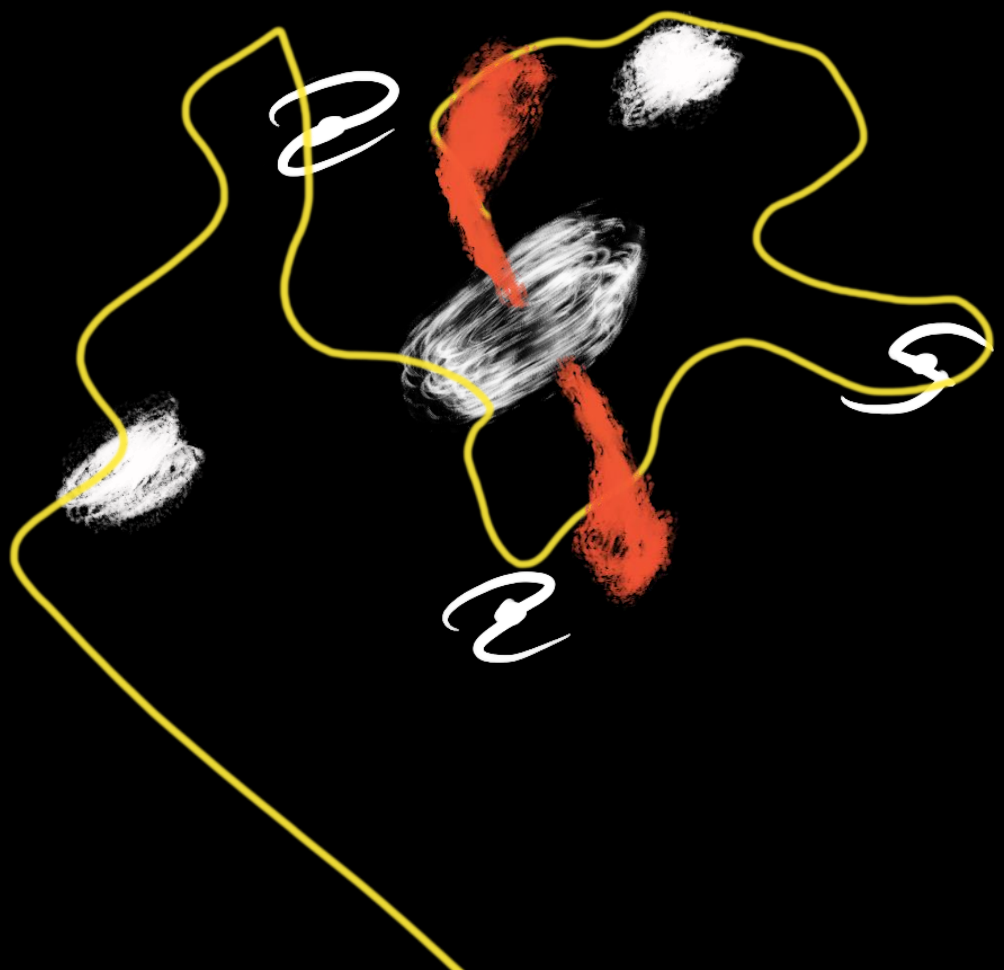

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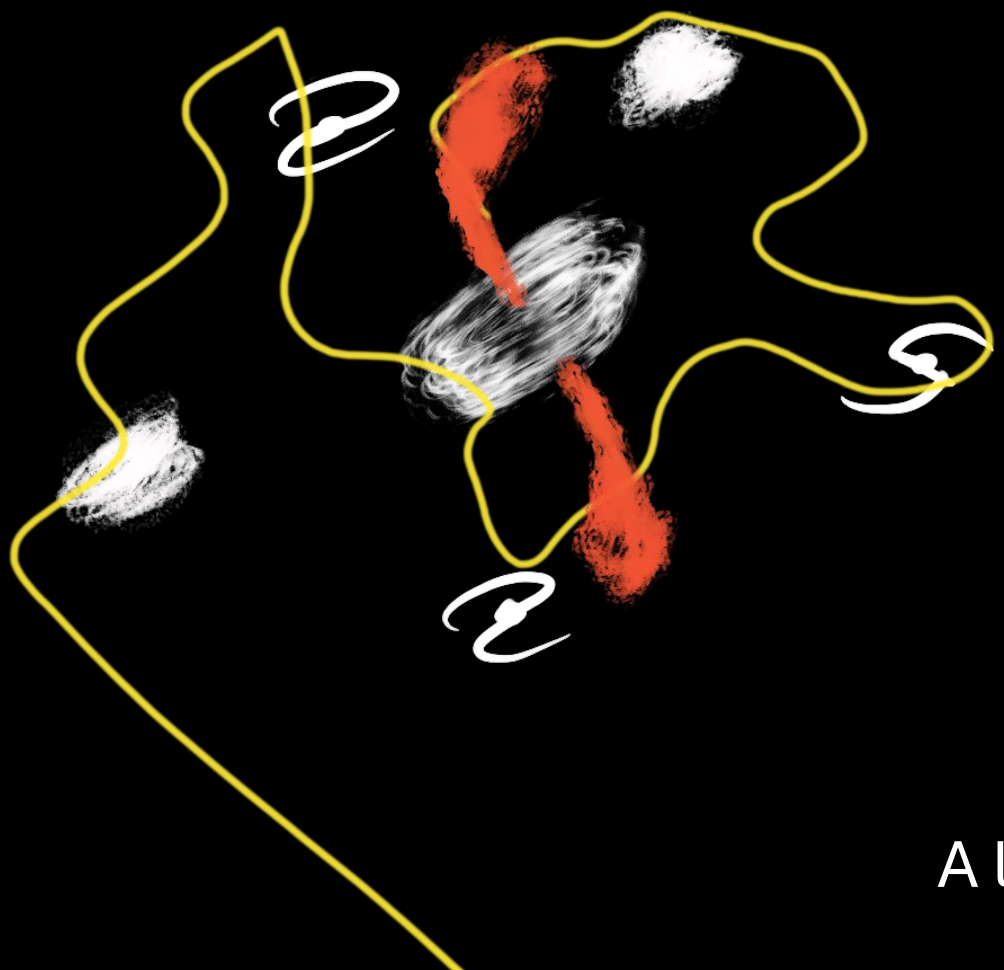

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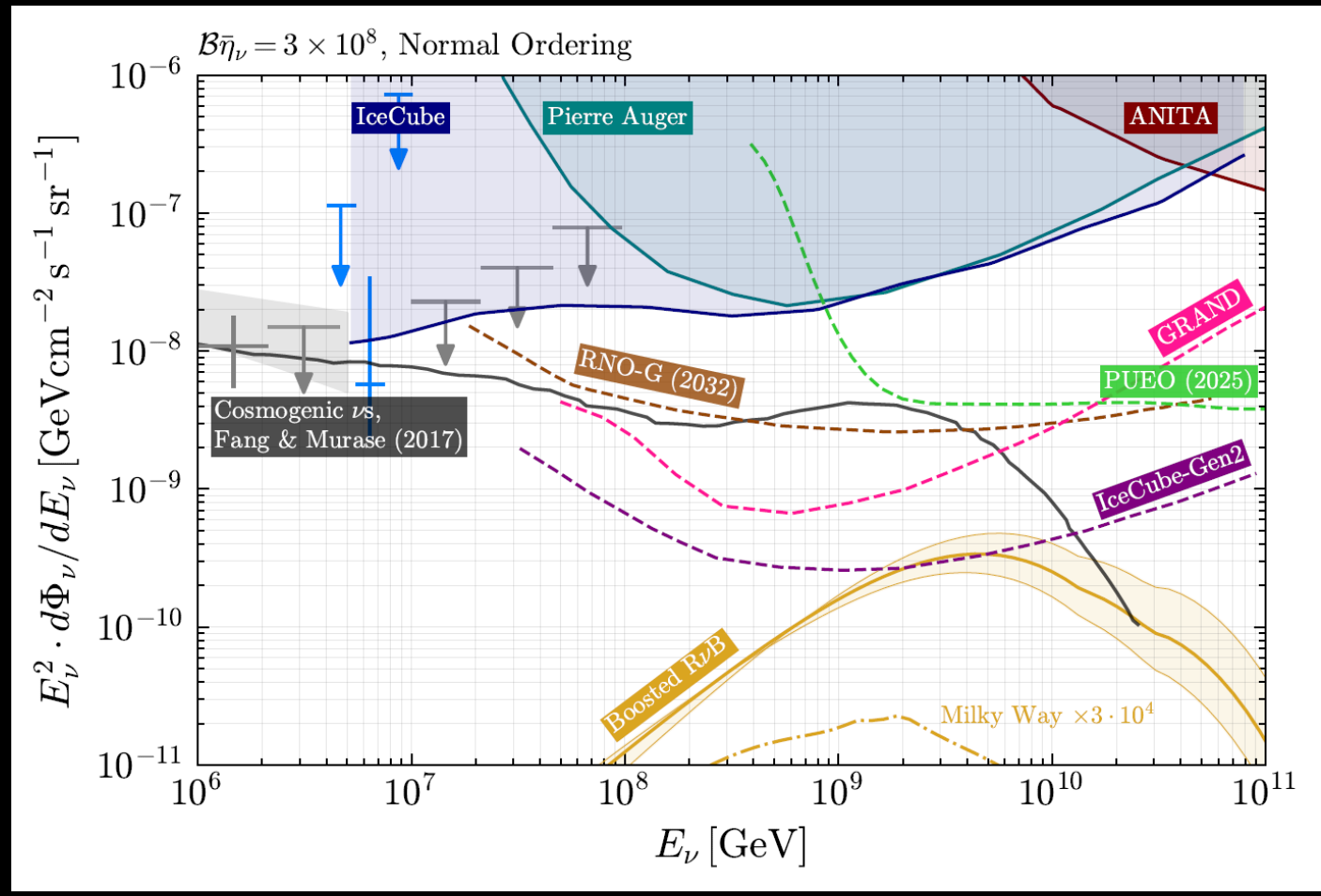
A lot of time to upscatter neutrinos!

Flux from Cosmic Reservoirs

- Improves previous bounds by orders of magnitude[1]. Now we ″only″ need $\eta_\nu \sim 10^8$
- Overdensities only on cluster scale, not diffuse
- Can tell apart from Cosmogenic neutrinos:
  - Spectral shape (DIS is crucial)
  - Flavour composition

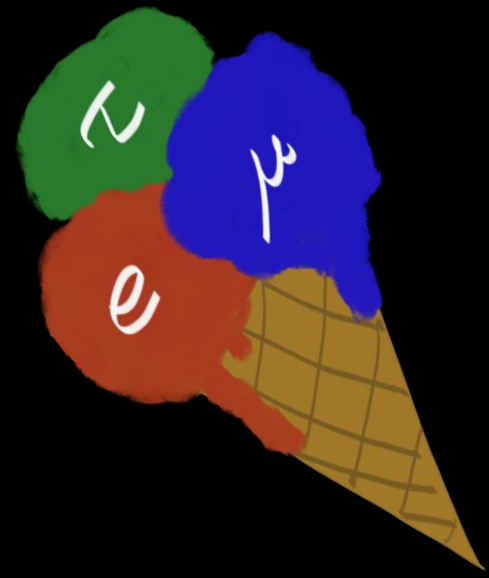


1. Ciscar-Monsalvatje, Herrera, Shoemaker 2402.00985

Thank you for your attention!

Backup slides

Flavour composition

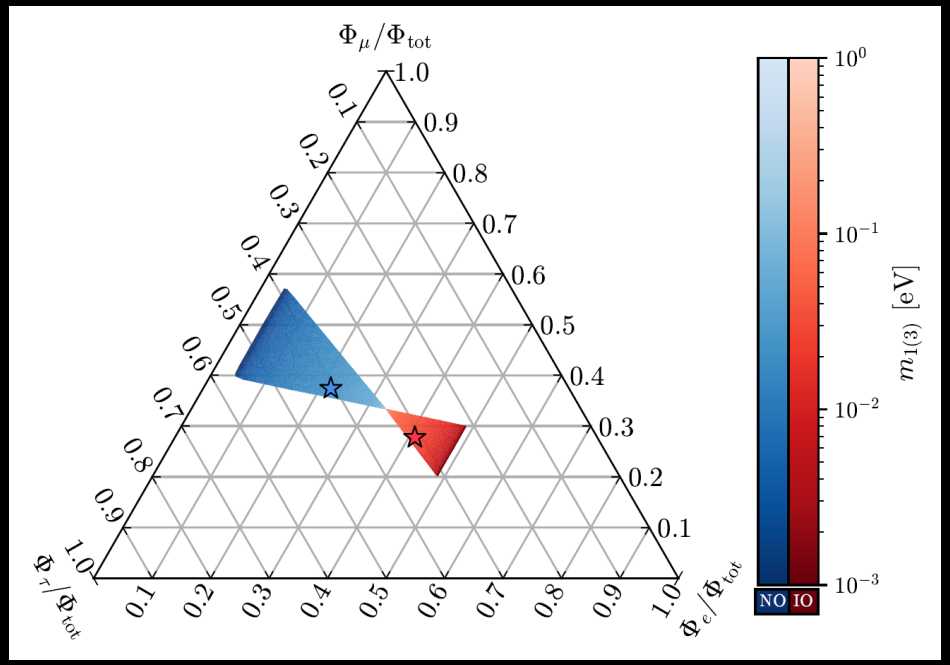


νs are non-relativistic ⇒ σ depends on m_ν

We computed the flux of mass eigenstates ν_i, preserved during propagation

At detection, the flux of flavour eigenstate ν_α is

$$\frac{d\Phi_\alpha}{dE_\nu} = \sum_i |U_{\alpha i}|^2 \frac{d\Phi_i}{dE_\nu}$$



Do these overdensities make sense?

- Limit to overdensity in SM: Pauli blocking, needs BSM
- **Smirnov, Xu 2201.00939** get close with new Yukawa interaction
- Limit on mass of the cluster: alleviated by non-homogeneous distribution