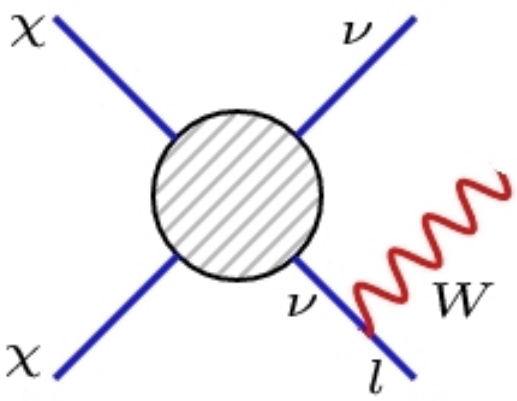
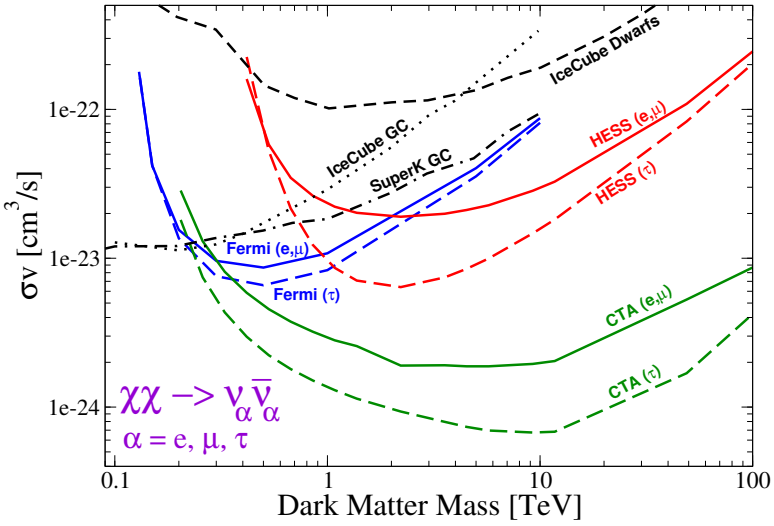
Gamma-ray limits on neutrino lines from dark matter annihilations





Based on 1602.05966 (JCAP) with
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MANITOP
Massive Neutrinos: Investigating their Theoretical Origin and Phenomenology

The annihilation rate into SM fields is a basic property of the dark matter particle

It hints at how the dm particle interacts

How strongly?

What's the mediator?

It determines the relic density via freeze-out

$$\Omega_{\rm DM} \propto 1/\langle \sigma v \rangle$$

It gives rise to indirect detection signals

$$\Phi_{\gamma,\nu,e^+,\bar{p}} \propto \langle \sigma v \rangle$$

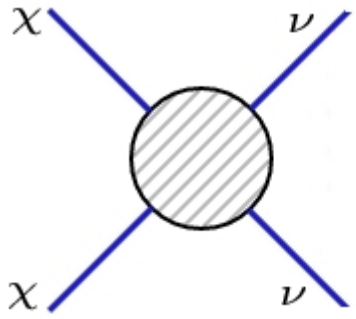
The $\nu\bar{\nu}$ final state sets an upper bound on the total dm annihilation rate into SM fields

Because ν's are the least detectable particles

$\langle \sigma v \rangle_{total} < \langle \sigma v \rangle_{\nu\bar{\nu}}$

Beacom et al, 2007

It gives rise to a line in the ν spectrum



$E_\nu = M_{\rm DM}$

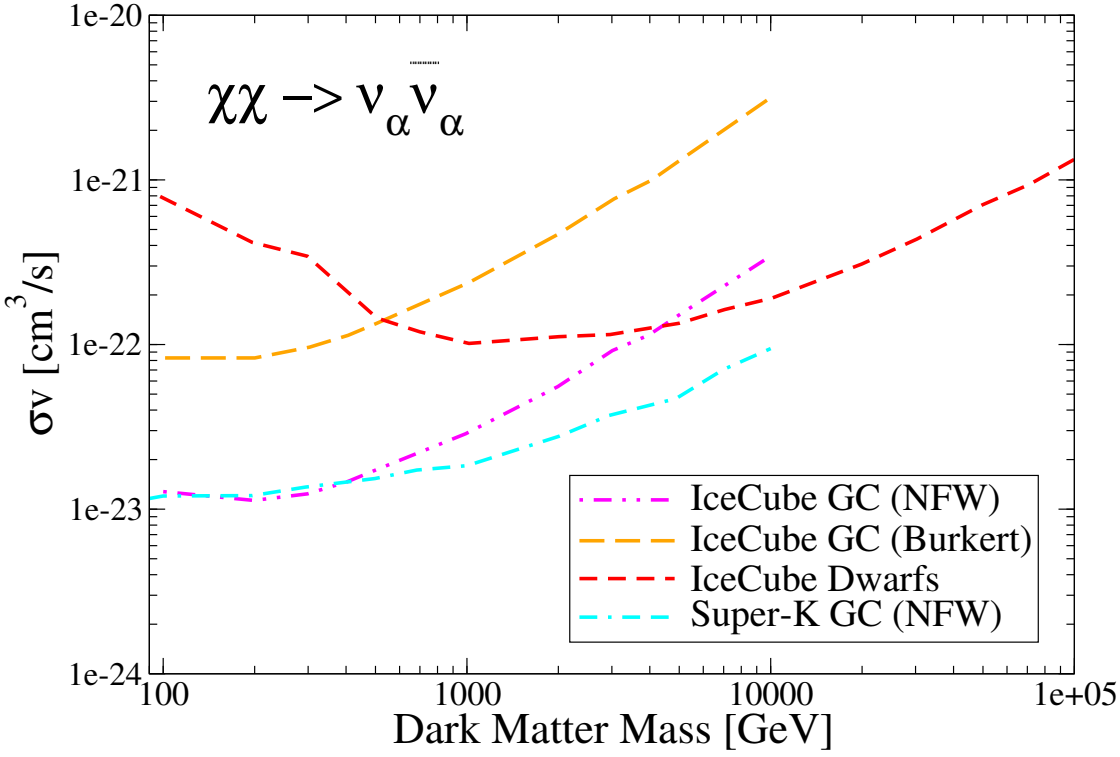
Many dm models feature such a final state

Z', Leptophilic, DM-ν masses

Neutrino experiments already provide some constraints on $\langle \sigma v \rangle_{\nu\bar{\nu}}$

From dm annihilation in the GC and dwarfs

What about gamma-ray data?

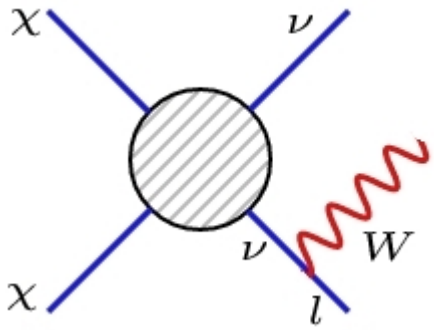


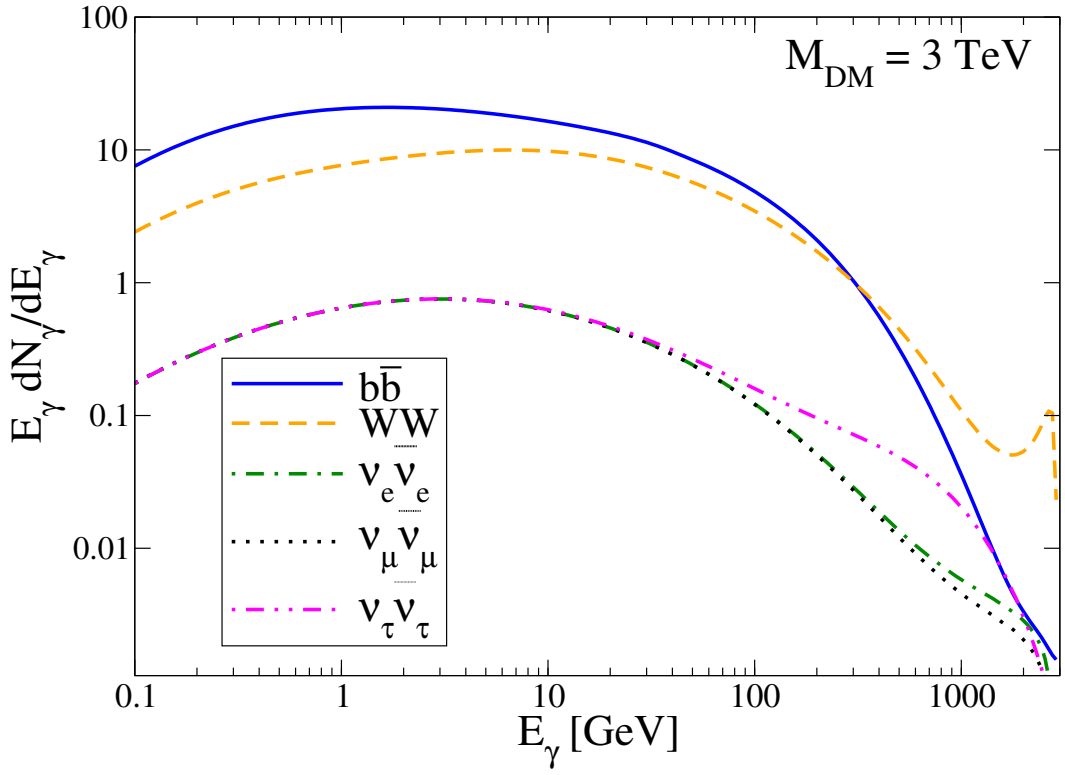
A continuous gamma-ray spectrum is always produced in association with ν lines

Induced by electroweak corrections

This spectrum is model-independent

The flux increases with the dm mass

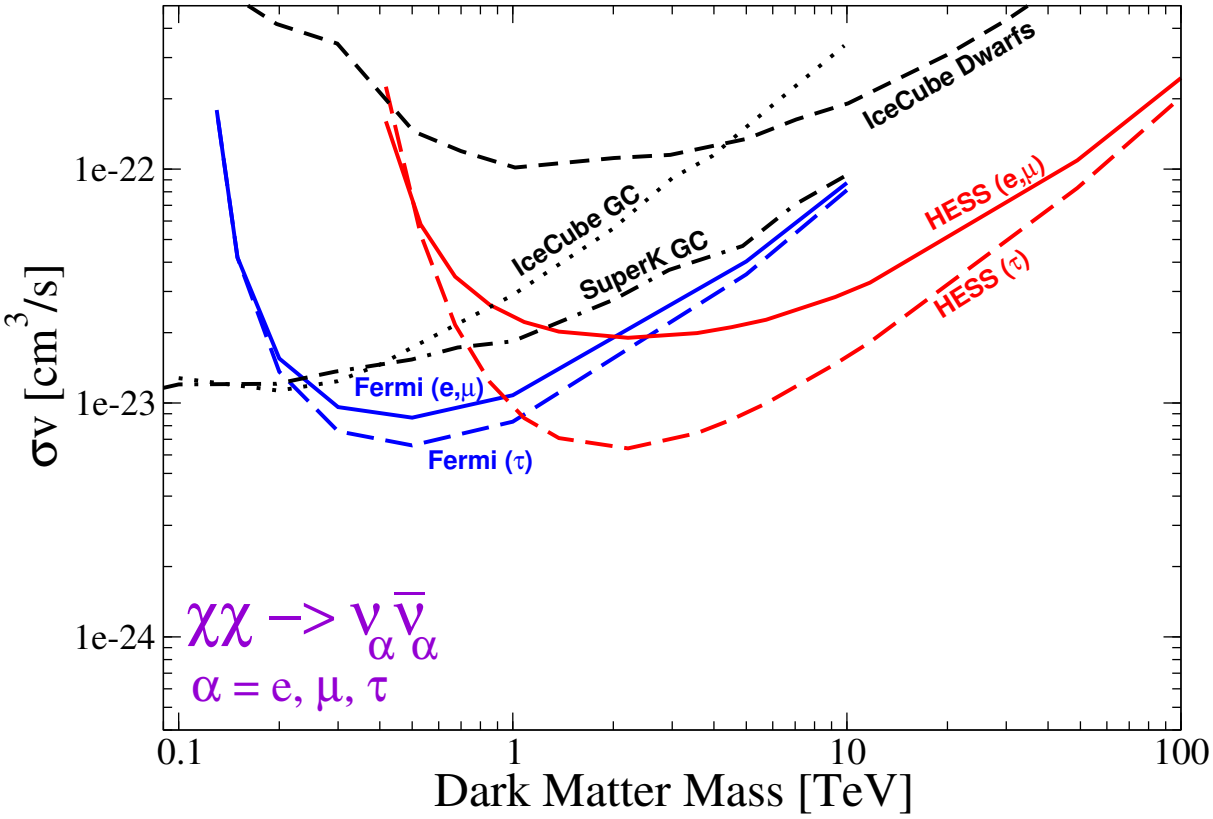




Neutrino lines can be indirectly searched for with Fermi-LAT and HESS data

They provide stronger limits above 200 GeV

They may distinguish the ν flavor



γ-ray data already set the most stringent bounds on ν lines from dm annihilation

CTA will improve the current limit by $\lesssim 10$

ν detectors will remain valuable at low masses

ν lines will likely be discovered in γ-rays