Heavy decaying dark matter at future neutrino radio telescopes

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based on
M. Chianese *et al*
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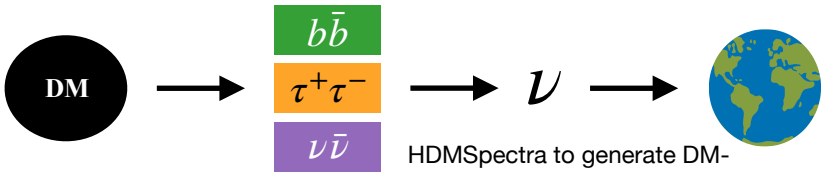
inVisibles
neutrinos, dark matter & dark energy physics

1. High energy neutrino fluxes from DM

NEUTRINO GENERATION FROM DM SCHEME:



HDMSpectra to generate DM-neutrino fluxes *C. W. Bauer et. al. [2007.15001]*

GALACTIC CONTRIBUTION:

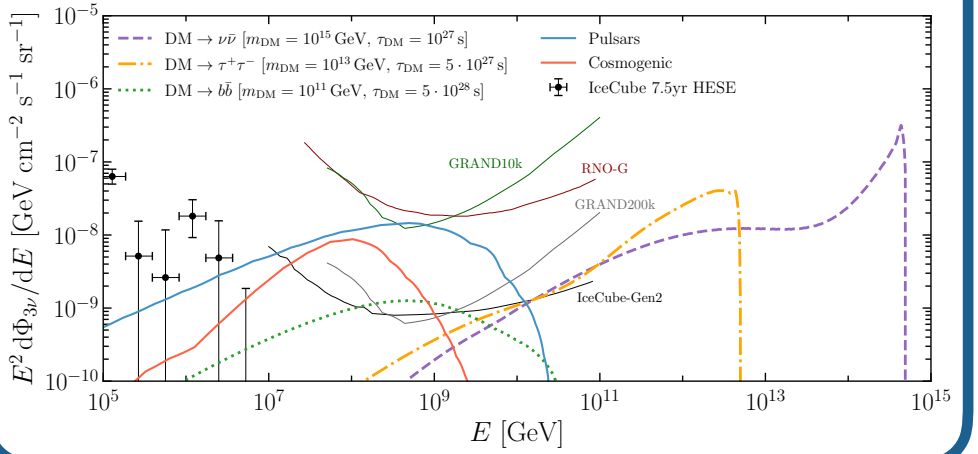
$$\frac{d\Phi^{gal.}_{\nu_\alpha+\bar{\nu}_\alpha}}{dE_\nu d\Omega} = \frac{1}{4\pi m_{DM}\tau_{DM}}\frac{dN_\alpha}{dE_\nu}\int_0^\infty ds\,\rho_{DM}[r(s,\ell,b)]$$

EXTRAGALACTIC CONTRIBUTION:

$$\frac{d\Phi^{ext.gal.}_{\nu_\alpha+\bar{\nu}_\alpha}}{dE_\nu d\Omega} = \frac{\Omega_{DM}\rho_c}{4\pi m_{DM}\tau_{DM}}\int_0^\infty \frac{dz}{H(z)}\frac{dN_\alpha}{dE'_\nu}\Big|_{E'_\nu=E_\nu(1+z)}$$

2. High energy neutrino flux scenario

COSMOGENIC NEWBORN PULSARS



3. New heavy decaying dark matter limits

STATISTICS:

$$p\left(N_{obs}|N_{astro}\right) = \frac{\left(N_{astro}\right)^{N_{obs}} e^{-N_{astro}}}{N_{obs}!}$$

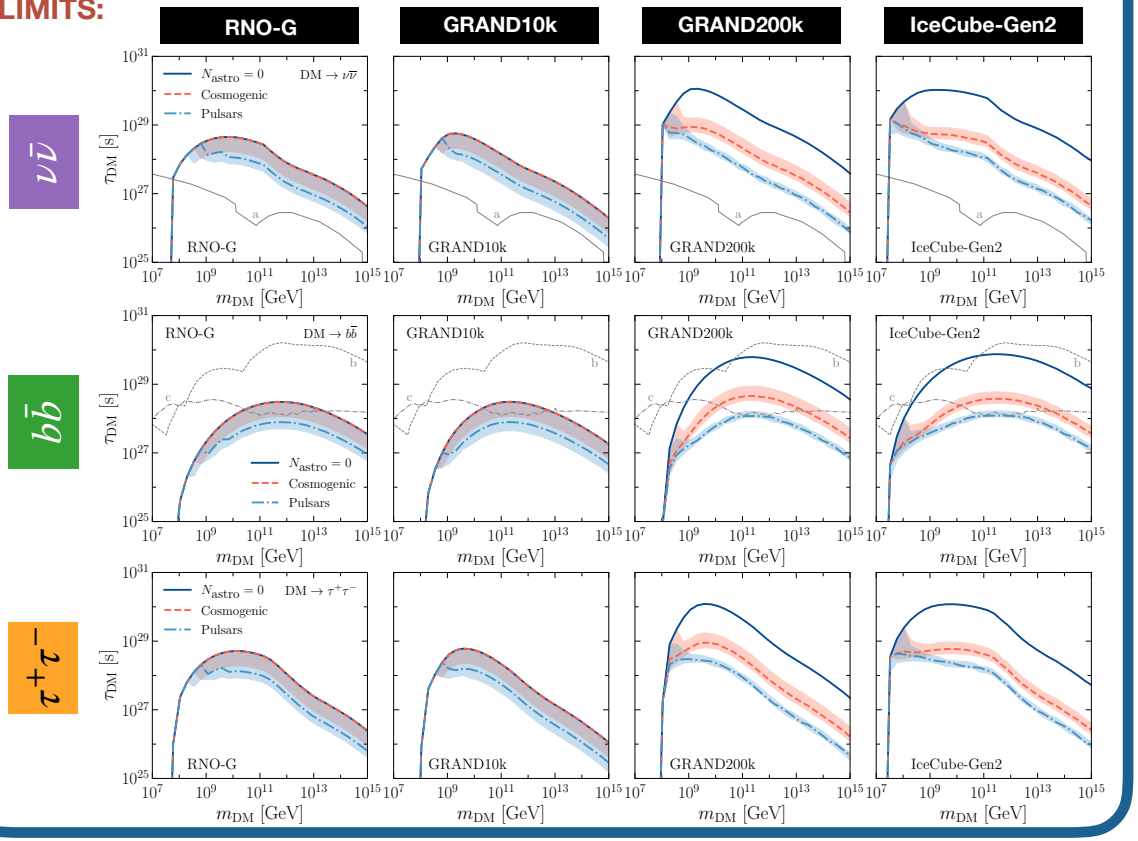
N_{obs} *stochastic random variable*
N_{astro} *expected astro events*

We constrain signals where the N_{events} of DM > N_{events} observed

$\mathscr{L}$ *assumed Poisson*

$$TS(m_{DM},\tau_{DM}) = \begin{cases} 0 & \text{for } n_{DM} < N_{obs} \\ -2\ln\left(\frac{\mathscr{L}(N_{obs}|n_{DM})}{\mathscr{L}(N_{obs}|N_{obs})}\right) & \text{for } n_{DM} \geq N_{obs} \end{cases}$$

LIMITS:



EXISTING LIMITS:

[a] Arman Esmaili, Alejandro Ibarra, and Orlando L.G. Peres, JCAP 11, 034 (2012), arXiv: 1205.5281 [hep-ph].

[b, c] Koji Ishiwata, Oscar Macias, Shin'ichiro Ando, and Makoto Arimoto, JCAP 01, 003 (2020), arXiv:1907.11671 [astro-ph.HE].

CONCLUSIONS:

Radio neutrino telescopes will have potential to detect a Dark Matter contribution. We have performed a forecast analysis to set conservative bounds on the lifetime of HDM particles with mass in the range $m_{DM} = 10^7 - 10^{15}$ GeV.