

Sterile Neutrino Dark Matter

DaMaSC III

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(1) Quantum Mechanical Limit: Dodelson & Widrow 1994

active neutrino scattering-induced de-coherence produces
 a relic density of sterile neutrinos -- *picks out keV scale rest masses, small vacuum mixing angles*

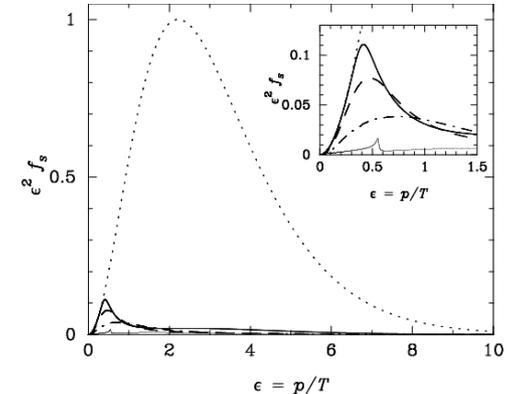
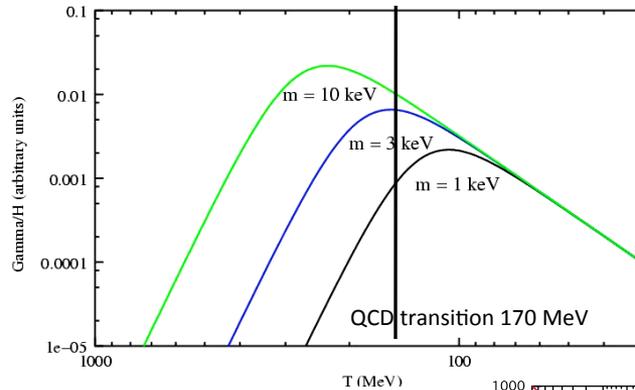
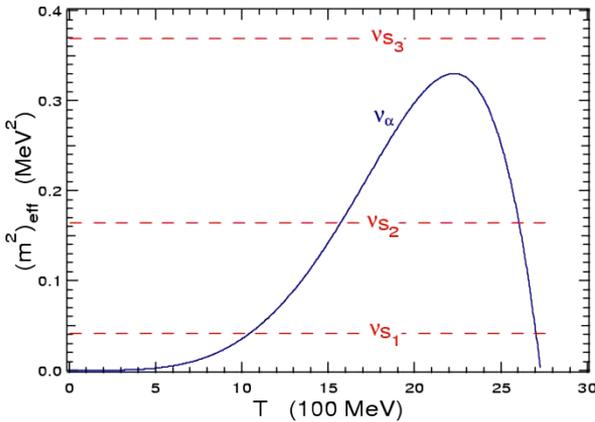
(2) Lepton number-driven resonant production: Shi & Fuller 1998; Abazajian, Fuller, Patel 2001; Abazajian '14

Like MSW, initial lepton number partially converted to a relic sterile neutrino population

-- *can work for smaller mixing angles, colder sterile neutrino relic energy spectrum*

-- *sterile neutrinos may allow you to make the lepton number*

e.g., Asaka & Shaposhnikov, "The nuMSM, dark matter, and baryon asymmetry", PLB 620, 17 (2005)

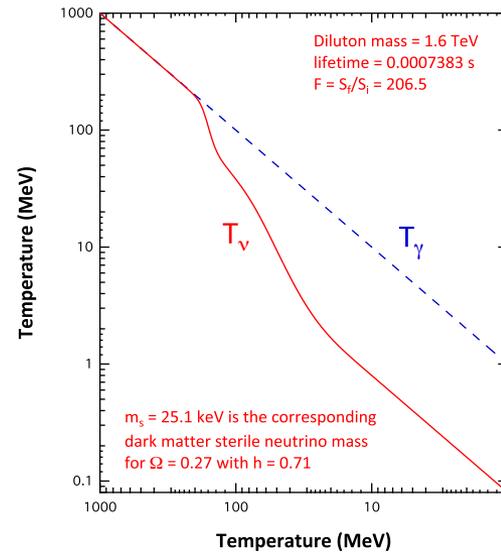


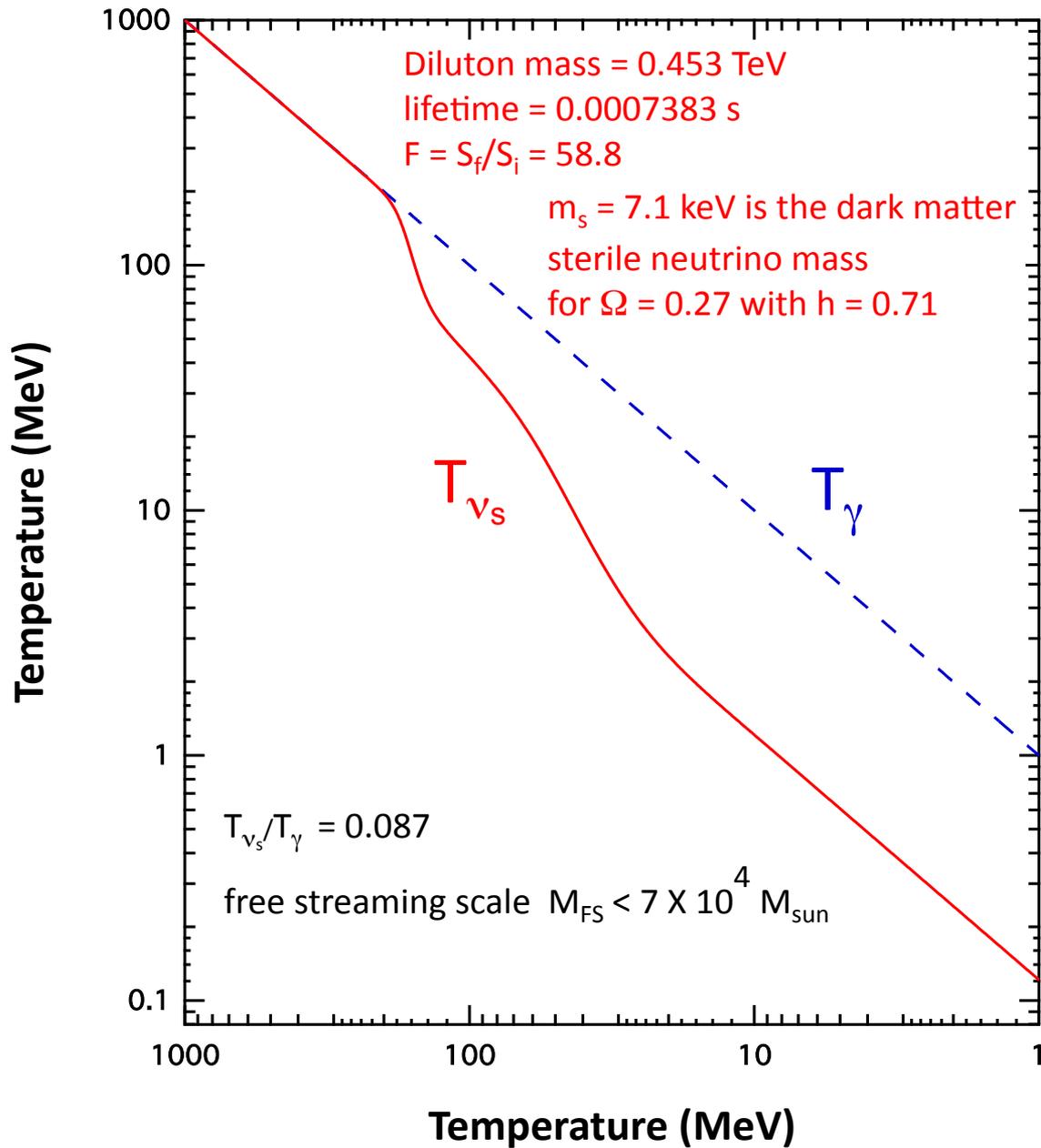
(3) Higgs decay; Dilution:

e.g., Asaka, Shaposhnikov, Kusenko (2006); Fuller, Kishimoto, Kusenko, Patwardhan (2014)

thermalize or partially thermalize steriles very early,
 then dilute them down to a DM relic density

-- *can produce relic sterile neutrino populations which are CDM
 for rest masses ~ 1 keV to ~ 10 MeV,
 with extremely small vacuum mixing angles*





7.1 keV sterile neutrino dark matter

two extreme limits for production compared/contrasted

<p>dark matter relic density produced</p>	<p>Resonantly (medium-enhanced de-coherent oscillations) at $T \gg 1 \text{ TeV}$ initial density $n_{\nu_s} = 0$</p>	<p>Dilution from thermal equilibrium at $T \gg 1 \text{ TeV}$ initial density $n_{\nu_s} \sim T^3$</p>
<p>dark matter character</p>	<p>Cool</p>	<p>Cold</p>
<p>Tooth Fairies</p>	<p>initial lepton number ($L_\nu \sim 10^{-3}$)</p>	<p><i>two</i> sterile neutrinos</p>
<p>Warts</p>	<p>assumptions about (absence of) new high energy scale physics</p>	<p>assumptions about high energy scale physics (need thermalization) baryogenesis requirements</p>
<p>Predictions/handles?</p>	<p>left over lepton number? \Rightarrow BBN, CMB ?</p>	<p>high energy scale physics \Rightarrow inflation, Higgs?</p>