Dark matter as Screened Ordinary Matter

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H.B. Nielsen[2], Niels Bohr Institut, and Colin D. Froggatt, Glasgow University

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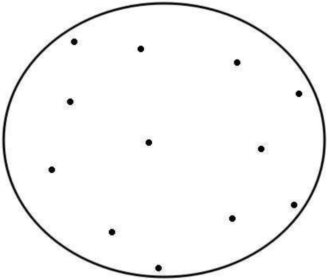
[2]Speaker at the Work Shop "What comes beyond the Standard Models" in Bled.

Our dark matter pearl model: Nuclei and electrons compressed inside a domaine wall



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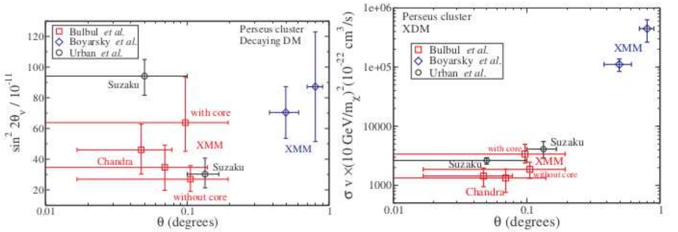

Figure 1: Left: mixing angle of decaying sterile neutrino that would give the measured fluxes for Perseus in the angular intervals indicated by horizontal error bars. Vertical bars correspond to errors in fluxes. Right: similar to left, but showing the cross section for excited dark matter models. Perseus data alone would favor the decaying DM scenario, or possibly XDM with slow decays of the excited state.

In the right hand picture the abcissa is the radius, i.e. the distance of the point at which the 3.5 keV X-ray is measured from the Perseus Galaxy Cluster center; and the ordinate is proportional to the per volume emitted 3.5 keV X-ray divided by the quantity $D_{DM}^2 v$ as estimated from gravitational effects of the dark matter. The left picture is analogous for a model where the dark matter

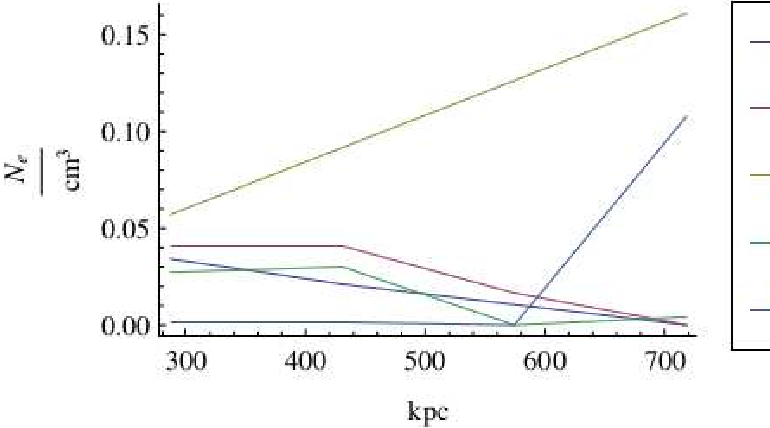

Figure 8: A profile of the electron number density across the Pers

Our Thesis

Effectively **Dark Matter Only deviate from Ordinary Matter by being Screened by Electrons to a Much Smaller Effective Size**, but of course we believe that it is due to our old model of pearls of a new vacuum. It is surrounded by a domain wall, but that we approximate to be non-interacting.

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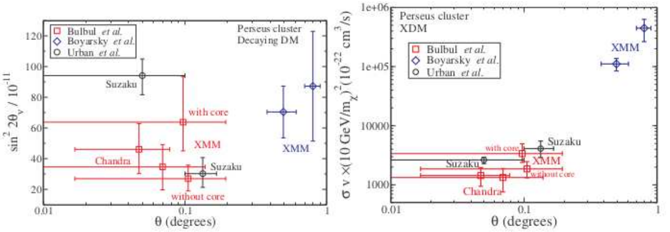

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1.	obs.points		PCO	MWC	TSNR	CF
2.	As if $\propto D_{DM}^2$	$\frac{N\sigma}{M^2}$	2.7 to 5.3 $\frac{10^{-27}cm^2}{(10GeV)^2}$	0.084 to 0.93 $\frac{10^{-27}cm^2}{(10GeV)^2}$	-	0.032± 0.006 $\frac{10^{-27}cm^2}{(10GeV)^2}$
3.	At earth	I	$5*10^{-5}$ $ph/cm^2/s$	$8*10^{-3}$ $ph/cm^2/s$	$2.2*10^{-5}$ $ph/cm/s$	-
4.	distance	d	$2.4*10^8 ly$	$2.7*10^4 ly$	$1.3*10^4 ly$	-
5.	emission	$4\pi*d^2*I$	$3.5*10^{49}$ ph/s	$6.6*10^{41}$ ph/s	$4.2*10^{40}$ ph/s	-
6.	mass		$8*10^{13}M_\odot$	$10^{10}M_\odot$	$10M_\odot$	-
7.	DM density	D_{DM}	$7.6*10^{-3}$ GeV/cm^3	$1GeV/cm^3$	$0.3GeV/cm^3$	-
8.	th.*X-ray gas d.	p_8	$4.6*10^{21}$ GeV/cm^2	-	$3.8*10^{21}$ GeV/cm^2	-
9.	area	A	$2.8*10^{49}cm^2$	-	$1.4*10^{39}cm^2$	-
10.	A*th.*X-ray g. d.	$A*p_8$	$1.0*10^{14}M_\odot$	-	$4.2*10^3M_\odot$	-
11.	number d.	n	$2*10^{-2}\ cm^{-3}$ or $10^{-3}cm^{-3}$	$1cm^{-3}$	$1\ cm^{-3}$	-
12.	th. $\propto$ rate	Ap_8nD_{DM}	$1.6*10^9$ $\frac{GeV*M_\odot}{cm^6}$	-	$1.3*10^3$ $\frac{GeV*M_\odot}{cm^6}$	-
12a	th. $\propto$ rate using mass	$mass*nD_{DM}$	$1.2*10^{10}$ $\frac{GeV*M_\odot}{cm^6}$	-	3 $\frac{GeV*M_\odot}{cm^6}$	
13.	const. ?	$\frac{4\pi I*d^2/D_{DM}/n}{A*th.*X-r.g.d.}$	$2.2*10^{39}$ $\frac{phcm^6}{GeVM_\odot s}$	- -	$3*10^{37}$ $\frac{phcm^6}{GeVM_\odot s}$	- -
13a	const. ?	$4\pi*I*d^2$	$1.1*10^{42}$		$1.4*10^{40}$	

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13a	const ? using mass	$\frac{4\pi*I*d^2}{mass*n*D_{DM}}$	$1.1*10^{42}$ $\frac{phcm^6}{GeVM_\odot s}$	- -	$1.4*10^{40}$ $\frac{phcm^6}{GeVM_\odot s}$	- -
14.	# SNe	$\#SNe$	$8*10^{12}SNe$	$900SNe$	$1SN$	-
15.	rate-prod.	$\#SN*D_{DM}*n$	$3*10^5$ $\frac{SNeGeV}{cm^6}$	$\frac{SNeGeV}{cm^6}$	0.3 $\frac{SNeGeV}{cm^6}$	-
16.	const. ?	p_5/p_{15}	$5*10^{42}$ $\frac{ph*cm^6}{sSNeGeV}$	$7.3*10^{39}$ $\frac{ph*cm^6}{sSNeGeV}$	$1.4*10^{41}$ $\frac{ph*cm^6}{sSNeGeV}$	-

Cline Frey work

When we compare with the Frey and Cline table we see that fit is not so perfect, but now we must remember that that there is a correction because the density of dark matter probably is fluctuating a round the average value used by Cline and Frey. Such fluctuation will make the experimental Cline Fye number be bigger than if one had had a quite smooth distribution.

Table of Cline and Frey

(1) Reference	(2) object	(3) ν mixing $\sin^2 2\theta_\nu$ $(\times 10^{-11})$	(4) fast decay $\langle\sigma v\rangle_f \cdot \left(\frac{10\,\mathrm{GeV}}{m_\chi}\right)^2$ $(10^{-22}\,\mathrm{cm^3 s^{-1}})$	(5) intermediate $\tau \sim 2\times 10^6$y or 2×10^7y	(6) slow decay $\langle\sigma v\rangle_s \cdot \left(\frac{10\,\mathrm{GeV}}{m_\chi}\right)^2$ $(10^{-22}\,\mathrm{cm^3 s^{-1}})$	(7) v disp. $\langle\sigma_v\rangle$ (km/s)
Bulbul *et al.* [1]	clusters	6 ± 3	480 ± 250		1200 ± 600	975
Bulbul *et al.* [1]	Perseus	$(26-60)$	$(1400-3400)$		$(4000-15000)$	1280
Boyarsky *et al.* [2]	Perseus	$(55-100)$	$(1-2)\times 10^5$		$(1-5)\times 10^4$	1280
Urban *et al.* [8]	Perseus	$(20-100)$	$(2600-4100)$		$(1-2)\times 10^4$	1280
Bulbul *et al.* [1]	CCO[a]	$(18-28)$	$(1200-2000)$		$(5100-8400)$	926
Boyarsky *et al.* [2]	M31	$(2-20)$	$\begin{cases}(10-30), & \text{NFW}\\ (30-50), & \text{Burkert}\end{cases}$	$\overset{\text{NFW}}{\to}\begin{cases}\text{unchanged}\\ (20-50)\end{cases}$	$(370-970)$	116
Boyarsky *et al.* [4]	MW	$(10-30)$	$\begin{cases}(0.1-0.7), & \text{NFW}\\ (50-550), & \text{Burkert}\end{cases}$	$\overset{\text{NFW}}{\to}\begin{cases}(1-8)\\ (16-110)\end{cases}$	$(400-3000)$	118
Riemer-Sørensen [3]	MW	$< (6-20)$	$< \begin{cases}(0.15-1.1), & \text{NFW}\\ (80-1200), & \text{Burkert}\end{cases}$	$\overset{\text{NFW}}{\to}\begin{cases}(2-12)\\ (24-170)\end{cases}$	$< (200-2000)$	118
Anderson *et al.* [5]	galaxies	$< (2-5)$	$< (270-620)$		$< (170-420)$	100
Malyshev *et al.* [6]	dwarfs	$< (3-5)$	$< (0.2-0.3)$		$< (0.1-0.2)$	10
Bulbul *et al.* [1]	Virgo	$< (18-23)$	$< (380-670)$		$< (2.5-4.1)\times 10^4$	643
Urban *et al.* [8]	Coma	$< (1.5-1.7)$	$< (130-200)$		$< (510-850)$	913

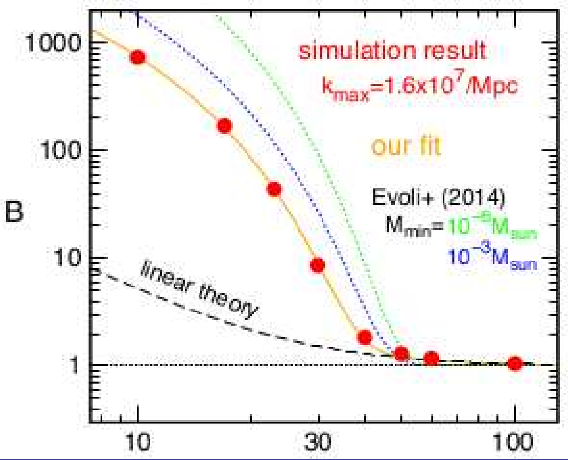
[a] Coma+Centaurus+Ophiuchus clusters

Table I: Column 3: best-fit values or upper limits on the sterile neutrino mixing angle, $\sin^2 2\theta$, assuming $\nu_s \to \nu\gamma$ for the 3.55 keV X-ray line. Column 4: corresponding values of the cross section for excited dark matter models with $\chi\chi \to \chi'\chi' \to \chi\chi\gamma\gamma$ for the case of prompt decay of χ'. For fast decays of XDM in the Milky Way, fits are given both to NFW and Burkert profiles. Column 5: for the case of excited state lifetimes $\tau \sim 2\times 10^6$y or 2×10^7y the MW cross sections change relative to NFW values in column 4 as shown, while others are unaffected. Column 6: same as column 4 but for slow decays (lifetime of order the dynamical time scale). Column 7: average velocity dispersion. Values for Coma, Centaurus clusters from ref. [21], and for Ophiuchus from [22].

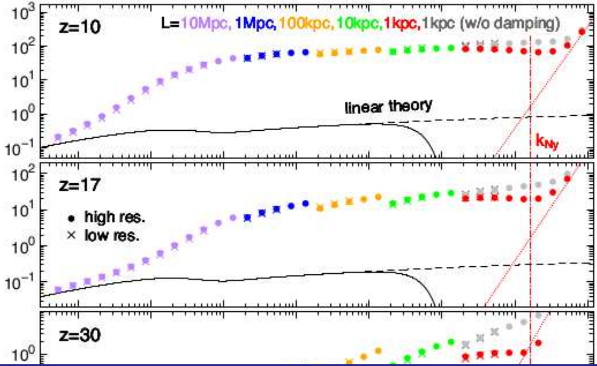
The factor B correcting for this effect is called the boost factor. In the article[**?**],which is though mainly interested in the old times of red shifts larger than z=10, we find in their figure 3, ours **??** that in the present days with low z the boost factor $B(z = today)$ is up about 2000. This shall presuably be taken as the effect of enhancement of a density squarecompared to just the quare of the the average density, with this average being the average over the whole world. However Cline and Frey use estimates of the average for much smaller regions. Thus the boost correction needed to correct the Cline Frey numers should only need the contribution from the high wave number k. This means that the 2000 is really only an upper bound estimate. If we took this boost factor B=2000 seriously, we should correct our from the stopping length being 1400 m (the DAMA depth) to get the bound

$$\text{"Cline-Frey quantity"} \leq 2000 * 2.5 * 10^{-22} cm^3/s \quad (1)$$

$$= 5000 * 10^{-22} cm^3/s. \quad (2)$$


simulation result
k_max=1.6x10^7/Mpc
our fit
Evoli+ (2014)
M_min= 10^-6 M_sun
10^-3 M_sun
linear theory
B
1000
100
10
1
10
30
100

We can attempt to correct a bit for the over-estimating by taking away the contribution from the very lowest wave numbers k.



In the article [?] we find estimate of the boost factor as a function of the mass of the host object for various parameters and models. Looking at the figure 3 in this paper, we might say that for galaxy cluster size objects this boost factor is about 10 while for only a single galazy it is more 6. We should trust these numbers more since they are for red shift $z = 0$ and objects for which one has any chanse to see the 3.5 keV line are rather close by objects with small red shifts.

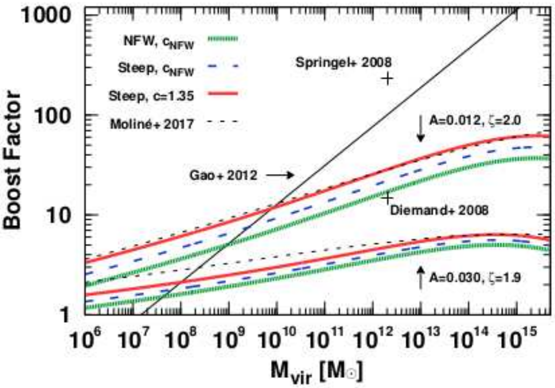


Figure 3. Boost factor as a function of halo virial mass. The data used in six thick curves are t
from Ishiyama [45]. Two subhalo mass functions, $dn/dm = A/M_{vir}(m/M_{vir})^{-\xi}$, are used ($A =$ (
$\xi = 2.0$, and $A = 0.030$, $\xi = 1.9$ [44,48]). Thick dotted curves are for the NFW profile, wher
empirical concentration-mass relation of field halos [44] are assumed for the full hierarchy of subh
Including the effect of steeper cusp of halos near the free streaming scale gives thick dashed cu
Besides, thick solid curves are results of incorporating the concentration of these halos derived