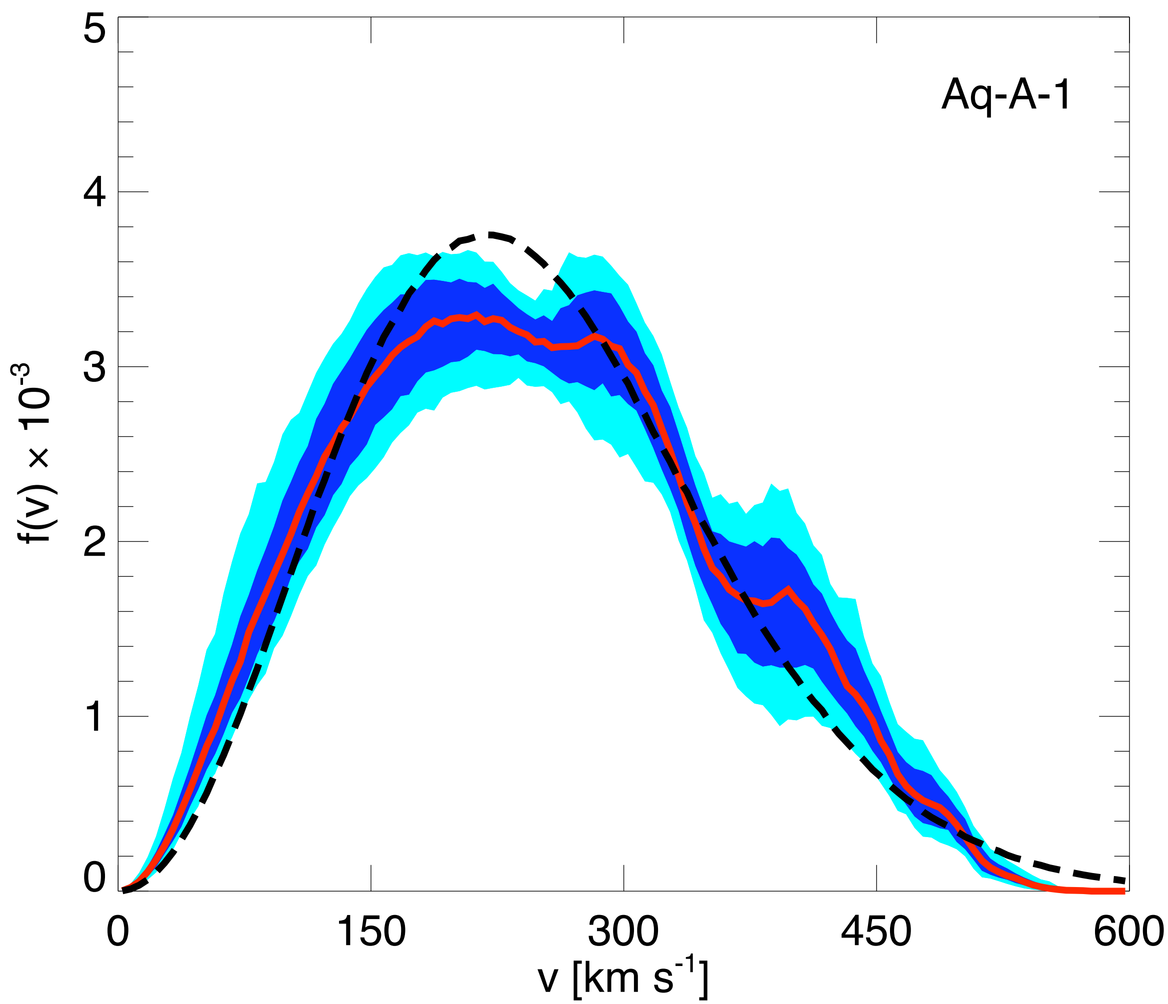
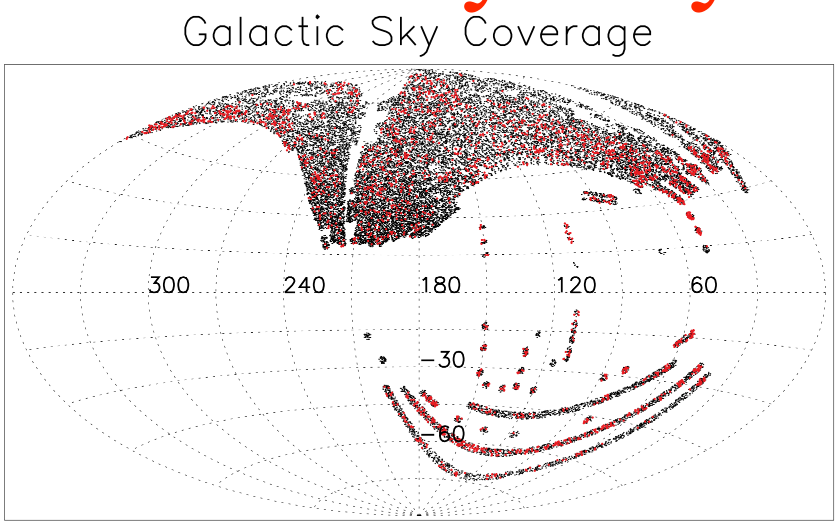


Vogelsberger et al., MNRAS 2009

Milky Way Rotation Curve

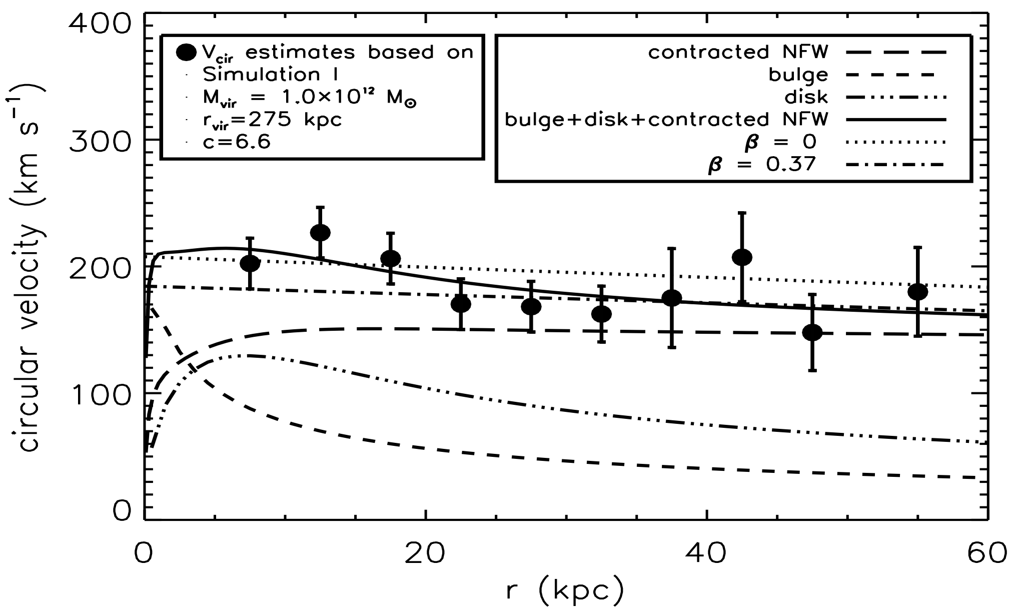


Xue et al. 2008 uses population of 2000 BHB stars out to 60 kpc

$$M(<\ 60\ \text{kpc})\ =\ 4.0 \pm 0.7 \times 10^{11} M_{\odot}$$

$$M_{\text{vir}} = 1.0^{+0.3}_{-0.2} \times 10^{12} M_{\odot}$$

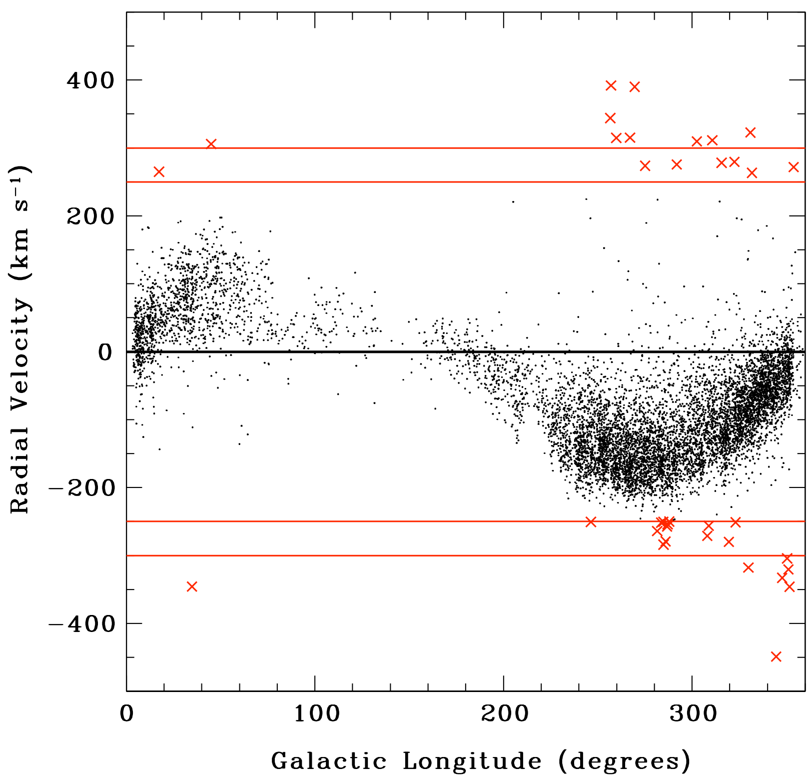
Mass estimates broadly consistent with those that use satellite dynamics (Frenk & White 1981, Little & Tremaine 1987, Kochanek 1996, Evans & Wilkinson 1999, Li & White 2008)

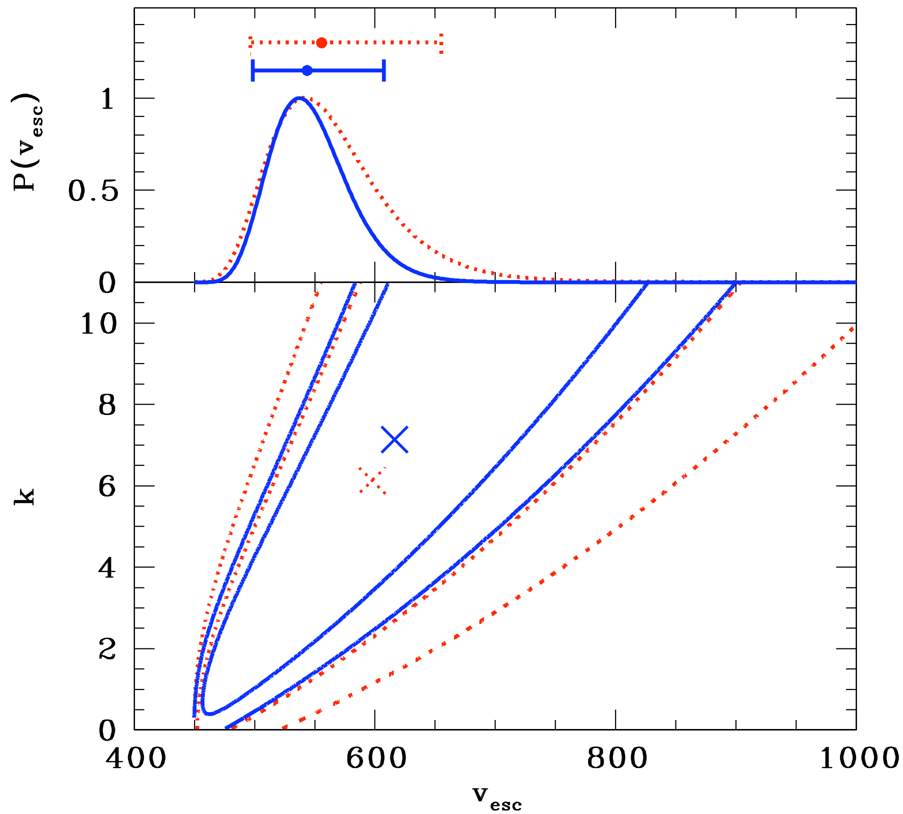


RAVE escape velocity constraints

$$f(|\mathbf{v}|\,|\,v_{\rm esc},k) \propto (v_{\rm esc}-|\mathbf{v}|)^k, \quad |\mathbf{v}|<v_{\rm esc}$$

$$f(|\mathbf{v}|\,|\,v_{\rm esc},k) = 0, \quad |\mathbf{v}| \geqslant v_{\rm esc},$$

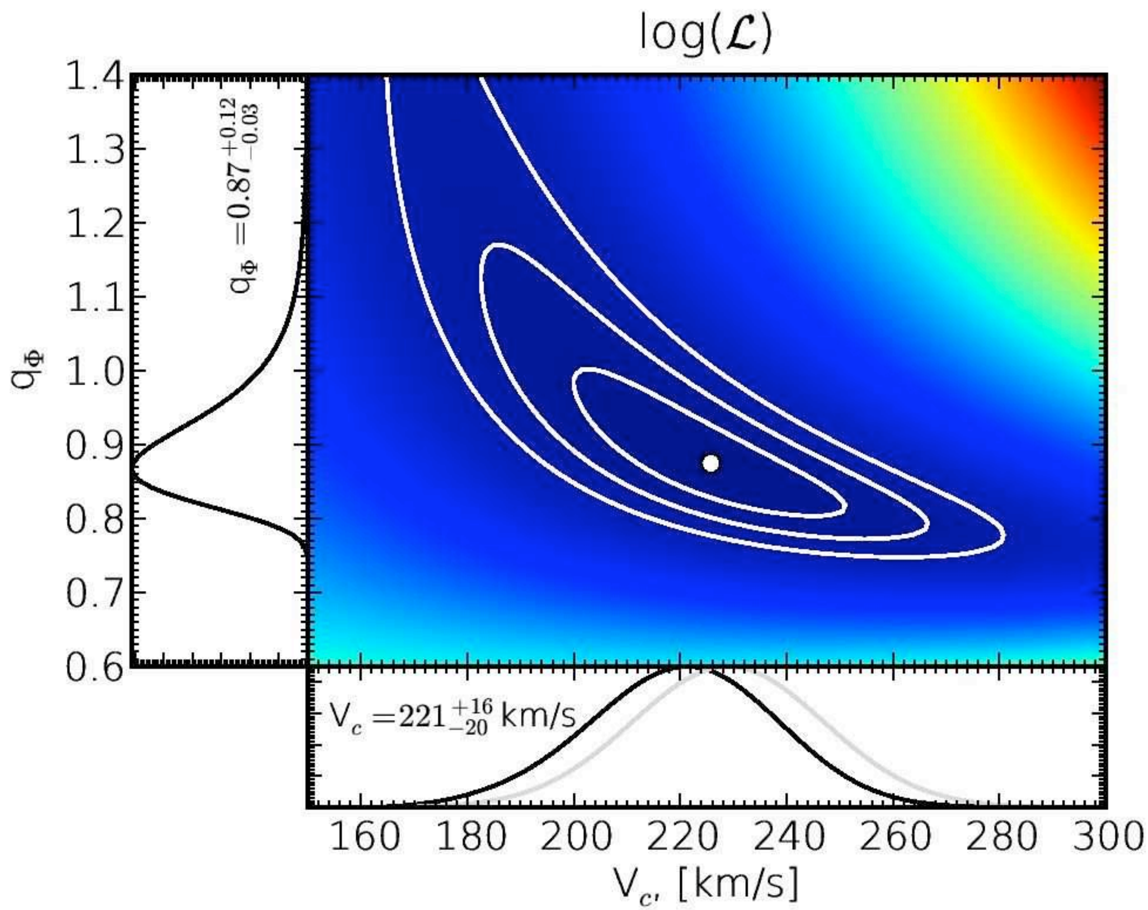




Escape Velocity

Smith et al.,

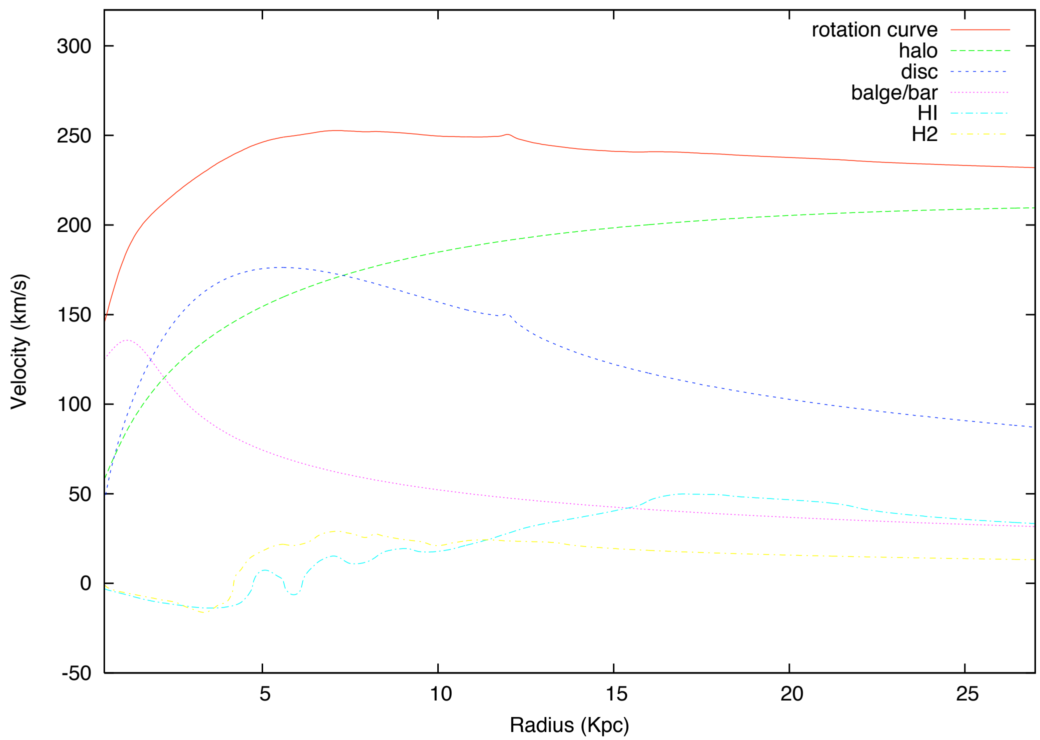
Mon.Not.Roy.Astron.Soc.379:755-772,2007



$$\Phi_{halo}(x,y,z) = \frac{v_{halo}^2}{2} \ln\left(x^2 + y^2 + \left(\frac{z}{q_{\Phi,halo}}\right)^2 + d^2\right)$$

Koposov et al. 2009

New Local Density Result



Catena & Ullio 2009

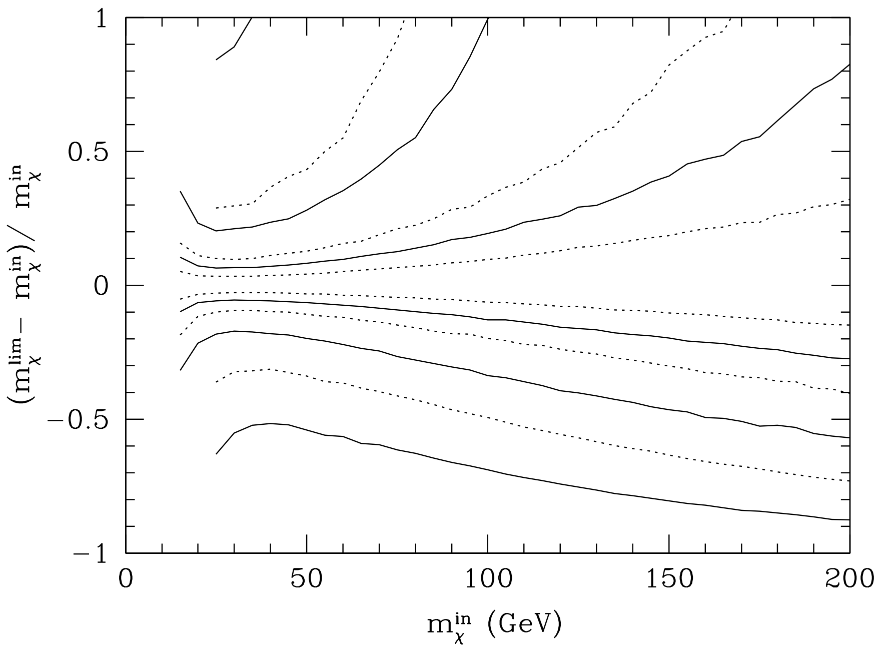
As determined from following data sets:

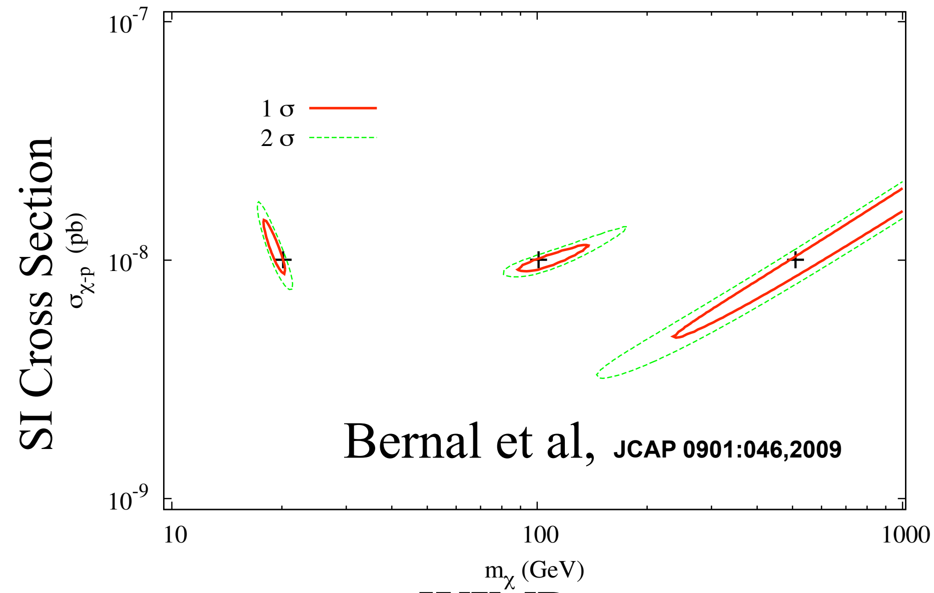
1) Terminal velocities
2) VBLI high mass SF regions
3) Cepheid PMs from Hipparcos
4) Local surface density
4) BHB stars
5) Satellite dynamics

For Einasto profile, local dark matter density is *0.385 +/ 0.027 GeV cm^{-3}*

(Similar result for NFW)

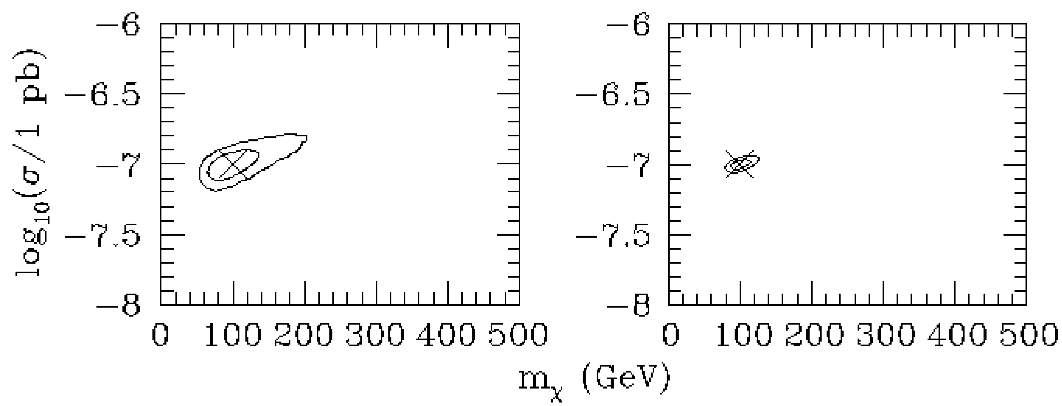
Constraining WIMP mass





WIMP mass

Variable but fixed circular velocity

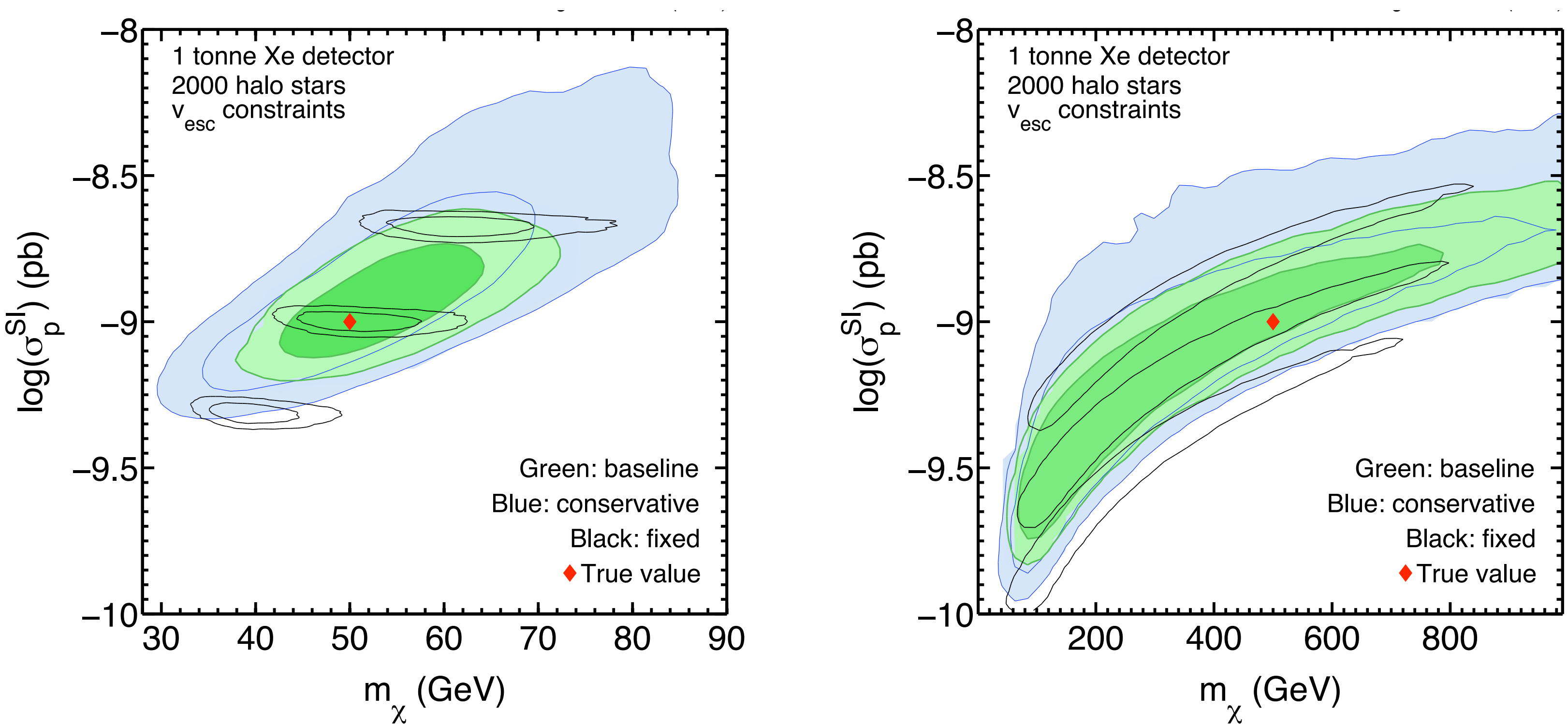


10^3-10^5 kg/day exposure for Ge

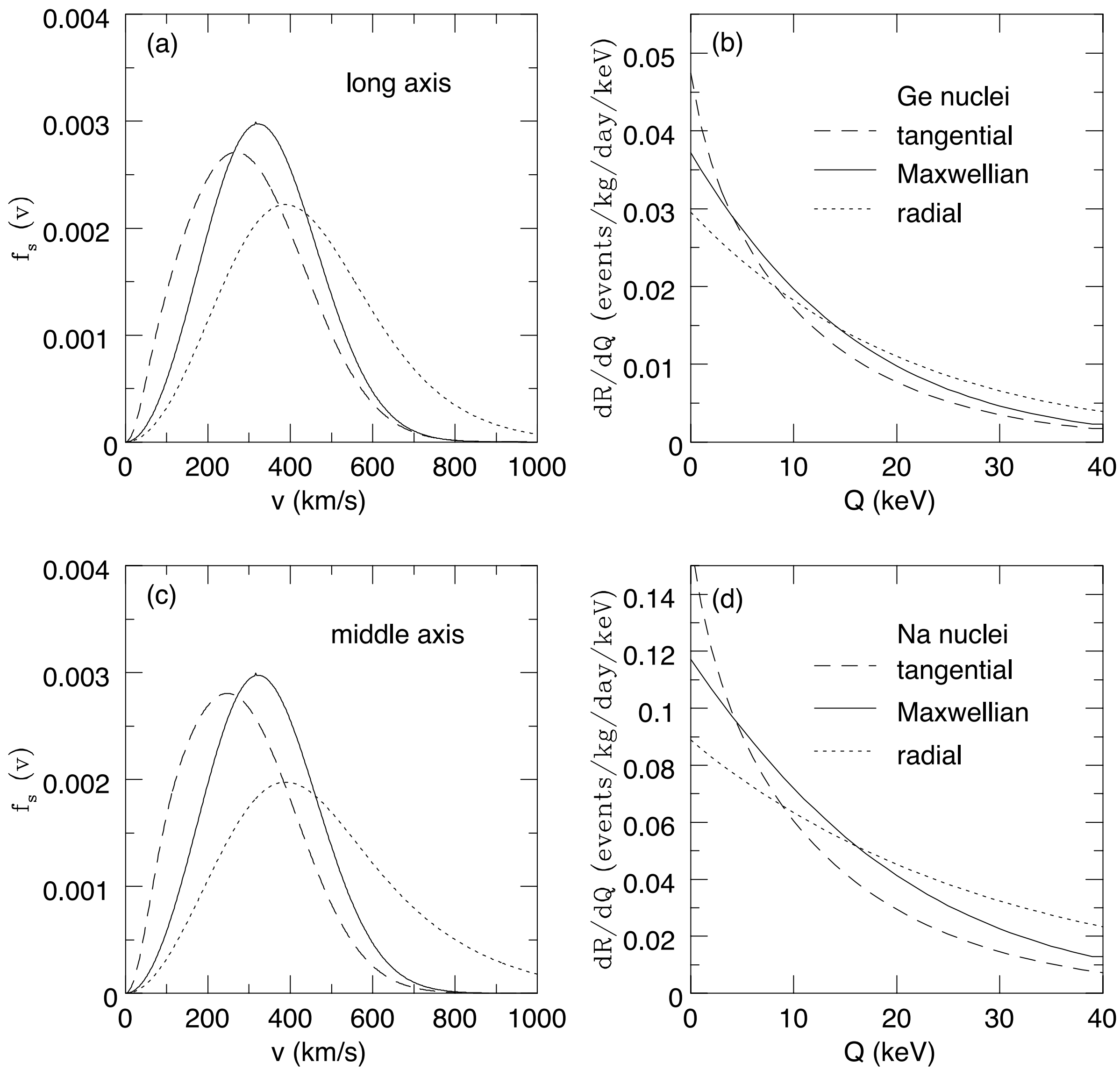
Low mass WIMPs more strongly constrained

Anne Green, **JCAP 0807:005,2008**

Shan, arXiv:0903.4320 [hep-ph]



1 tonne Xe detector
2000 halo stars
v_esc constraints
Green: baseline
Blue: conservative
Black: fixed
True value
log(σ_p^SI) (pb)
m_χ (GeV)
−8
−8.5
−9
−9.5
−10
30
40
50
60
70
80
90
200
400
600
800


(a)
long axis
$f_s(v)$
0.004
0.003
0.002
0.001
0
0
200
400
600
800
1000
v (km/s)
(b)
Ge nuclei
tangential
Maxwellian
radial
dR/dQ (events/kg/day/keV)
0.05
0.04
0.03
0.02
0.01
0
0
10
20
30
40
Q (keV)
(c)
middle axis
$f_s(v)$
0.004
0.003
0.002
0.001
0
0
200
400
600
800
1000
v (km/s)
(d)
Na nuclei
tangential
Maxwellian
radial
dR/dQ (events/kg/day/keV)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
10
20
30
40
Q (keV)