Phase-space structure in the local dark matter distribution. The nearest neighbours. We then fit a power law to the resulting distribution, which may result from small-scale structure.

In the following analysis we will often compare the six level-2 simulations then demonstrates that this tail has similar shape and scale to the total volume fraction in subhalos of all six halos, with a maximum circular velocity of 208 km/s. The resulting DPDFs to have unit integral. They then provide a probability of finding a point at a given distance from the center of the halo.

In Fig. 1 we show the DPDFs measured in this way for all level-2 halos, and for all level-2 simulations of Aq-A (top panel) and for all level-2 halos a major halo (and thus also the total volume fraction) in subhalos of all six halos with about 6 kpc from the Galactic Centre, but also the fluctuations are due to DM particles passing through laboratory detectors. It is important to note that the dark matter distribution is not a simple function of position in the halo, but rather a complex integration of the distribution of dark matter particles over all times.

For each halo we begin by diagonalizing the inertia tensor for Aq-B-2 to Aq-F-2. To facilitate this comparison, we scale the halos in mass and radius by the constant required to give each a maximum circular velocity of 208 km/s. We estimate the local DM distribution at each point in our simulations using an SPH smoothing kernel adapted to the 64 kpc box size.

The radius restriction reflects our desire to probe the inner regions. However, Aq-A-2 and Aq-A-1 give quite similar shape and scale to the total volume fraction in subhalos of all six halos, with a maximum circular velocity of 208 km/s. The resulting DPDFs to have unit integral. They then provide a probability of finding a point at a given distance from the center of the halo.

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

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

\[ M_{\text{vir}} = 1.0^{+0.3}_{-0.2} \times 10^{12} M_\odot \]
RAVE escape velocity constraints

\[ f(|v| \mid v_{\text{esc}}, k) \propto (v_{\text{esc}} - |v|)^k, \quad |v| < v_{\text{esc}} \]

\[ f(|v| \mid v_{\text{esc}}, k) = 0, \quad |v| \geq v_{\text{esc}}, \]

Smith et al.,
The contours show the correction of all three velocity components for the Sun's motion. Constraints on the shape of the dark matter halo or at least complicating inferences on the shape of the DM potential should still be relatively large, weakening the potential should still be relatively large, weakening

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

Koposov et al. 2009
New Local Density Result

As determined from following data sets:
1) Terminal velocities
2) VBLI high mass SF regions
3) Cepheid PMs from Hipparcos
4) Local surface density
5) BHB stars

For Einasto profile, local dark matter density is

\[ 0.385 \pm 0.027 \text{ GeV cm}^{-3} \]

(Similar result for NFW)

Catena & Ullio 2009
Constraining WIMP mass

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

Low mass WIMPs more strongly constrained

Anne Green, JCAP 0807:005,2008

FIG. 2: Reconstruction of $m_\chi \sigma_{SI}$ under various assumptions: dark matter halo parameters fixed to assumed values (solid, black), marginalizing over baseline halo model (filled/green), marginalizing over conservative halo model (filled/blue). In all cases inner and outer contours represent 68% and 95% c.l. limits. The red diamond gives the true value. The left panel is for a 50 GeV WIMP mass, the right panel assumes a 500 GeV WIMP (in the right panel, we only show 68% c.l. for the case of fixed galactic parameters for clarity). The lower (upper) solid black contours illustrate the bias in the reconstruction assuming incorrect values for the local dark matter density a factor of 2 above (below) the true value.

component [23] may be considered. Further one may account for the non-Maxwellian velocity distribution [24], and a multi-component spectral fit to the WIMP and astrophysical background spectra may be incorporated [25, 26]. An analysis along these lines will be crucial to interpret the limits and measurements from forthcoming direct detection experiments.

Acknowledgments – We thank Henrique Araujo, Laura Baudis, Blas Cabrera, Jodi Cooley-Sekula, and Alastair Currie for several important discussions. Support for LES was provided by NASA through Hubble Fellowship grant HF-01225.01 awarded by the Space Telescope Science Institute, which is operated by the Association of Universities for Research in Astronomy, Inc., for NASA, under contract NAS 5-26555. RT would like to thank the EU FP6 Marie Curie Research and Training Network "UniverseNet" (MRTN-CT-2006-035863) for partial support.

Figure 5. The distribution of speeds and the differential rate on the major axis (a,b) and the intermediate axis (c,d) of the logarithmic ellipsoidal model with $p = 0.9$ and $q = 0.8$. In each panel, results are given for a radially anisotropic $\gamma = -1.78$ solution (dotted line) and tangentially anisotropic $\gamma = 16$ solution (dashed line), as well as a comparison Maxwellian (full line). Panel (b) assumes that the WIMPs are scattering off $^{73}$Ge nuclei, while panel (d) assumes that they are scattering off $^{23}$Na nuclei. The computations are carried out for the date of June 2nd when the total rate is at a peak.

A stable neutral supersymmetric particle (generally the neutralino) is one of the current favourites (e.g., Jungman et al. 1996). One promising way of confirming this hypothesis involves direct detection experiments. Broadly speaking, the experiments work by measuring the recoil energy of a nucleus in a low background laboratory detector which has undergone a collision with a WIMP. The aim is to measure the number of events per day per kilogram of detector material as a function of the recoil energy $Q$. Although this deposited energy is minute and the WIMP-nucleus interaction is very rare, there are a number of such experiments in progress around the world. These include the UKDMC collaboration operating in Boulby mine (e.g., Smith et al. 1996), the DAMA collaboration in the Gran Sasso Laboratory (e.g., Bernabei et al. 1999), which both use NaI scintillators, and the CDMS experiment located underground at Stanford University, which uses cryogenic germanium and silicon detectors (e.g., Gaitskell et al. 1997).

In all these experiments, the detection rate depends on the mass $m_\chi$ and cross-section $\sigma_0$ of the WIMP, as well as the mass of the target nucleus $m_N$ in the detector. But, it also depends on the local dark matter density $\rho_0$ and the speed distribution $f_s(v)$ of WIMPs in the Galactic halo near the Earth. Calculations have already been performed using Maxwellian velocity distributions for singular and corotated isothermal spheres, as well as for self-consistent flattened halo models (e.g., Freese et al. 1985; Jungman et al. 1996; Kamionkowski & Kinkhabwala 1998; Belli et al. 1999). One of our aims here is to assess the likely uncertainties in the detection rates caused by halo triaxiality and velocity anisotropy. The formulae for the calculation of rates in direct detection experiments are summarised in the review of Jungman et al. (1996). We give here only the bare details.