Erratum: The radial velocity dispersion profile of the Galactic halo: constraining the density profile of the dark halo of the Milky Way

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Erratum: The radial velocity dispersion profile of the Galactic halo: constraining the density profile of the dark halo of the Milky Way

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The paper 'The radial velocity dispersion profile of the Galactic halo: constraining the density profile of the dark halo of the Milky Way' was published in Mon. Not. R. Astron. Soc. **364,** 433–442 (2005). In the manuscript we compared the observed radial velocity dispersion profile for the Milky Way halo, $\sigma_{\mathrm{GSR},*}$, to the radial velocity dispersion profile predicted by several dark matter models, $\sigma_{r,*}$. The observed profile is derived from the heliocentric velocities of halo tracers, corrected for the solar motion and the local standard of rest (LSR) velocity. Equation (3) of the above manuscript, which relates $\sigma_{r,*}$ and $\sigma_{\mathrm{GSR},*}$, is incorrect. The correct equation is:

$$\sigma_{\mathrm{GSR},*}(r) = \sigma_{r,*}(r)\,\sqrt{1-\beta H(r)}, \qquad (1)$$

This error affected our determination of the best-fitting values of the parameters in our mass models (section 2.3 of the original paper).

For the models presented in section 2.3.1, for which the velocity anisotropy β was constant with radius, we now obtain the following.

(i) Assuming that the dark matter halo follows the density distribution of a pseudo-isothermal sphere (equation 5), we now obtain a minimum $\chi^2_{\mathrm{min}} = 37$ for a nearly isotropic velocity ellipsoid ($-0.2 \lesssim \beta \lesssim 0.1$ at the 1σ level) and a core radius very close to zero with a 1σ upper limit of 0.22 kpc. As in the original manuscript, we conclude that this profile provides a poor fit to the data.

(ii) A Navarro–Frenk–White (NFW) dark matter halo of concentration $c = 10$ yields a best-fitting virial mass $M_{\mathrm{v}} = 1.5 \pm 0.2 \times 10^{12}\ \mathrm{M}_{\odot}$ and a purely radial velocity anisotropy ($\chi^2_{\mathrm{min}} = 83$). For an NFW halo of concentration $c = 18$ we obtain a $\chi^2_{\mathrm{min}} = 35$ for a virial mass $M_{\mathrm{v}} = 9.4^{+1.4}_{-0.9} \times 10^{11}\ \mathrm{M}_{\odot}$, very close to our earlier estimate and in agreement with previous works; the velocity anisotropy is once again almost purely radial. As in the original manuscript, the model with $c = 18$ is favoured with respect to lower concentrations. Fig. 1 shows the above described best-fitting NFW profiles, with overlaid the favourite model of Klypin, Zhao & Somerville (2002).

(iii) The Truncated Flat (TF) model for the dark matter halo gives a best-fitting mass $M = 5^{+2.5}_{-1.7} \times 10^{11}\ \mathrm{M}_{\odot}$ and $\beta = 0.6 \pm 0.3$ ($\chi^2_{\mathrm{min}} = 7$). This model now gives a better representation of the data at every radius. The predicted velocity anisotropy is now radial and

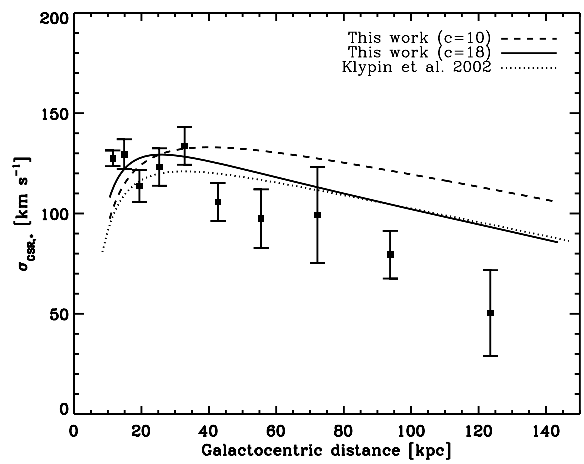

Figure 1. Observed radial velocity dispersion (squares with error bars) overlaid on two of the best-fitting models for the NFW mass distributions (dashed line: $c = 10$; solid line: $c = 18$). The dotted curve corresponds to the Galactocentric radial velocity dispersion profile obtained using the preferred model (B1) of Klypin et al. (2002). This figure replaces the bottom panel of fig. 4 in the original manuscript.

in agreement with the value observed in the solar neighbourhood; however, the best-fitting mass is considerably smaller than in previous works. We tested the Galactocentric radial velocity dispersion profile predicted for a TF model with mass equal to the upper 1σ value from our best fit and a velocity anisotropy equal to the lower 1σ β, and found that it gives a good representation of the data. Fig. 2 shows the best-fitting TF profile compared to the best-fitting models of Wilkinson & Evans (1999) and Sakamoto, Chiba & Beers (2003).

For the NFW mass models with a velocity anisotropy β that varies with radius (section 2.3.2), we obtain a best-fitting virial mass $M_{\mathrm{v}} = 2.4\,(\pm\,0.2, 0.4) \times 10^{12}\ \mathrm{M}_{\odot}$ (at the 1σ, 2σ level) with a $\chi^2_{\mathrm{min}} = 46$ for the radially anisotropic model (equation 12); for the tangentially anisotropic model (equation 13) we obtain $M_{\mathrm{v}} = 1.2(\pm\,0.1, 0.3) \times 10^{12}\ \mathrm{M}_{\odot}$ (at the 1σ, 2σ level) with a minimum $\chi^2_{\mathrm{min}}=17$ (model $\beta - \mathrm{tg_{toy}}$) and $M_{\mathrm{v}} = 2.2(\pm\,0.2, 0.3) \times 10^{12}\ \mathrm{M}_{\odot}$ with a minimum $\chi^2_{\mathrm{min}} = 23$ (model $\beta - \mathrm{tg_{SN}}$).

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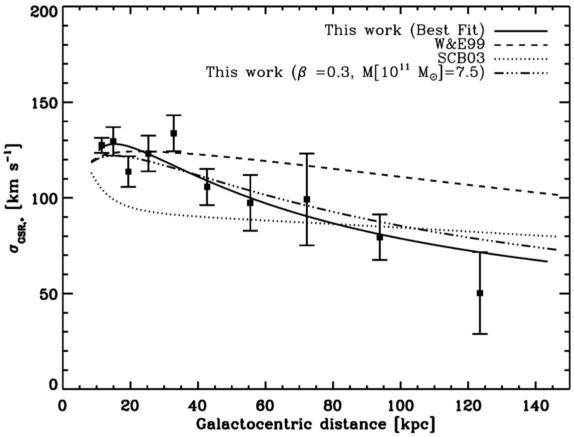

Figure 2. Observed radial velocity dispersion (squares with error bars) overlaid on the best-fitting model for the TF mass distribution (solid line). The dashed line shows the Galactocentric radial velocity dispersion obtained using the best-fitting parameters from Wilkison & Evans (1999) and the dotted line using the best-fitting parameters from Sakamoto et al. (2003). The dashed–double-dotted line shows $\sigma_{\mathrm{GSR},*}$ for a TF model with mass equal to the upper 1σ value from our best fit and a velocity anisotropy equal to the lower 1σ β. This figure replaces the right-hand panel of fig. 5 in the original manuscript.

Therefore, we find that our main conclusions remain unchanged. In the hypothesis of constant velocity anisotropy, a TF model represents the data best because of the steep density profile. An NFW model, which has a shallower density profile with respect to a TF model, overpredicts the observed dispersion at large radii. A velocity anisotropy that becomes more tangentially anisotropic with radius is needed for an NFW model of $c = 18$ to be in agreement with the data.

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