

The Local Dark Matter Density inferred from Grand Rotation Curve of the Milky Way Galaxy

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Abstract

We constructed a grand rotation curve (GRC) of the Milky Way, which covers a wide range of the Galaxy from the Galactic Center to ~ 1 Mpc, for the galactic constants of $R_0 = 8$ kpc and $V_0 = 200$ km s $^{-1}$ ($\Omega_0 = V_0/R_0 = 25$ km s $^{-1}$ kpc $^{-1}$) (Sofue et al. 2009; Sofue 2009, 2012). By least-squares fitting of the GRC by a de Vaucouleur bulge, exponential disk, and NFW dark halo (Navarro et al. 1996), we determined the parameters of individual mass components. Using the obtained parameters, we estimated the local dark matter density in the solar neighborhood at $R_0 = 8$ kpc to be $\rho_0^\odot = (6.12 \pm 0.80) \times 10^{-3} M_\odot \text{ pc}^{-3} = 0.235 \pm 0.030 \text{ GeV cm}^{-3}$. The value is consistent with the current estimation of $0.2 - 0.4 \text{ GeV cm}^{-3}$ by Weber and de Boer (2010). On the other hand Salucci et al. (2010) derived a larger value, 0.43 ± 0.11 . This larger value may be due to their adopted larger value of $\Omega_0 = 30.3 \text{ km s}^{-1} \text{ kpc}^{-1}$, because the local density is approximately proportional to Ω_0^2 .

References

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