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A novel determination of the local dark matter density

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We present a novel study on the problem of constructing mass models for the Milky Way, concentrating on features regarding the dark matter halo component. We have considered a variegated sample of dynamical observables for the Galaxy, including several results which have appeared recently, and studied a 7- or 8-dimensional parameter space - defining the Galaxy model - by implementing a Bayesian approach to the parameter estimation based on a Markov Chain Monte Carlo method. The main result of this analysis is a novel determination of the local dark matter halo density which, assuming spherical symmetry and either an Einasto or an NFW density profile is found to be around 0.39 GeV cmˆ-3 with a 1-sigma error bar of about 7%; more precisely we find a rho_DM (R_0) = 0.385 \pm 0.027 GeV cmˆ-3 for the Einasto profile and rho_DM (R_0) = 0.389 \pm 0.025 GeV cmˆ-3 for the NFW. This is in contrast to the standard assumption that rho_DM (R_0) is about 0.3 GeV cmˆ-3 with an uncertainty of a factor of 2 to 3. A very precise determination of the local halo density is very important for interpreting direct dark matter detection experiments. Indeed the results we produced, together with the recent accurate determination of the local circular velocity, should be very useful to considerably narrow astrophysical uncertainties on direct dark matter detection.

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