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Dark matter capture by the Sun: revisiting velocity distribution uncertainties

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A neutrino signal coming from the Sun would be a smoking gun of WIMP detection. This possibility relies on the DM capture by the Sun driven by the local DM distribution assumptions: the local mass density and the velocity distribution. In this context, we revisit those astrophysical hypotheses. We focus especially on the DM velocity distribution considering different possibilities beyond the popular Maxwellian distribution. Some alternatives can be considered either through analytical approaches or from cosmological simulations of spiral galaxies. Most of the fitting formulas used to constrain the local velocity distribution function fail to describe the peak and the high velocity tail of the velocity distribution observed in simulations, the latter being improved when adding the local escape velocity of DM into the benchmark fitting models. In addition we test the predictions by the Eddington inversion method and study the importance of the galactic dynamical history. Finally we estimate the intrinsic variance of the capture formalism and its effect previously introduced capture boost with respect to the Maxwellian distribution.

Summary

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