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New Insights Into GeV-scale Dark Matter From Rotation Curves, Direct Detection Experiments, Astrophysics and Cosmology

Tuesday, 7 December 2021 07:00 (40 minutes)

I will report on two new developments in GeV-scale dark matter phenomenology.

1) A comprehensive analysis of 129 SPARC rotation curves – Loizeau + GF (2021) – significantly disfavors standard LCDM profiles. The best-fit is obtained with a (puffy) dark matter disk; a flexible Einasto profile is next best, and SIDM considerably worse.

2) Previous analyses of constraints on DM-baryon interactions in the micro-barn to barn range inappropriately used the Born approximation scaling $\sigma_A = (A \mu_A / \mu_p)^2 \sigma_p$ to relate cross-sections on different nuclei. This dramatically distorts the interpretation for much of the relevant parameter space, for instance significantly exaggerating the He contribution to the CMB limits. I will report results of Xu+GF(2021a) - a complete reanalysis of limits from CMB, XQC, CRESST, gas clouds, Ly-alpha, and dwarf galaxies, using exact non-perturbative treatment. I will also report new stronger limits - Xu+GF(2021b) - from combining the constraints of a novel dewar experiment with those from BBN.

The puffy disk result hints at a DM-baryon interaction, as can arise with Sexaquark Dark Matter, but the other searches for evidence of interactions are not yet sensitive enough to expect to find a signal.

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