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On Prolate Halos and Rotation Curves

Kirill Zatrimaylov

Abstract: We propose a simple geometrical mechanism for the flattening of galactic rotation curves at large distances, the local compression of field lines around their planes induced by elongated dark mater halos, and elaborate on its possible role in Nature. Fitting a number of rotation curves from the SPARC database with deformed versions of two popular models of dark matter halos, namely the Navarro-Frenk-White (NFW) and the Burkert profiles, we collect some evidence that prolate dark mater distributions improve by five or more percent the agreement with data for a wide fraction of the galaxies that we have examined. Moreover, the rotation curves of some galaxies seem to suggest the presence of string type objects at their centers which might be black hole jets comprised of baryonic or dark matter, tidal streams, or cosmic strings. If taken at face value, all these results would favor cold dark matter models (CDM) with respect to scenarios based on self-interacting dark matter (SiDM), modified gravity, or modified Newtonian dynamics (MOND).In addition, we propose a new method for the study of rotation curves, namely performing the same analysis for different types of DM profiles (NFW, Burkert, Einasto, etc.) to see whether or not certain key features persist. We believe this approach could be useful for making model-independent conclusions about the properties of dark halos.

Keywords: Dark matter, halo morphology, cosmic strings

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