Contribution ID: **12** Type: **not specified**

A Relativistic Explanation for the Darkness of Galactic Halos

Tuesday 15 April 2025 10:00 (30 minutes)

In the Cold Dark Matter (CDM) paradigm, galaxies form when gas within dark matter (DM) halos cools and collapses toward the centre of the DM potential well, creating a rotating disc structure that triggers star formation. Dark matter candidates span over 90 orders of magnitude in mass, from ultralight bosons to massive black holes. However, despite extensive large-scale underground experiments (e.g., LUX-ZEPLIN, XENON, PANDA-X) and particle accelerator experiments at CERN's LHC, no confirmed detection of a dark matter particle has been made. In this paper, we demonstrate that the observed features of galactic halos, typically attributed to dark matter particles, can be explained by a simple relativistic model, without invoking the notion of dark particles. We apply a recently proposed theory of relativity of information (1-3) to a rotating thin disk and derive predictions for the radial density distributions of luminous and nonluminous matter, and their mass fractions in disk galaxies, based solely on their measured velocity curves. We utilized these predictions to infer about the distributions and fractions of luminous and nonluminous components in 52 disk galaxies from the SPARC database. In all galaxies tested, the nonluminous density component is predicted to dominates over the luminous component starting at a radial velocity of Vmax /3, where Vmax is the maximum measured velocity. The build-up of the nonluminous density and the simultaneous decrease in the luminous component density are predicted to be continuous and depend only on the dimensionless velocity $\beta(r)= v(r)/Vmax$. The proposed relativistic model avoids the cusp-core problem and successfully accounts for several empirical results unexplained by the CDM model, including the strong coupling between luminous and nonluminous matter (e.g., the RAR, the BTFR), and the flat circular velocity of isolated galaxies. We conclude that the darkness of galactic halos is likely a relativistic phenomenon, governed by rotational velocities rather than the presence of exotic dark matter particles. If this conclusion is corroborated, the considerable resources devoted to the search for dark matter particles could be redirected toward more beneficial scientific endeavours.
Keywords: Dark matter, nonluminous matter, dark matter in galaxies, matter-dark matter coupling, rotation curve, SPARC, Radial Acceleration Relation, Baryonic Tully-Fisher Relation. (1) Suleiman, R. A model of dark matter and dark energy based on relativizing Newton's physics. WJCMP 2018, 8, 130-155. (2) Suleiman, R. Relativizing Newton (Nova Science Publishers. N.Y, 2019). (3) Suleiman, R. A local-deterministic alternative to quantum gravity. Paper presented at the XII International Conference on New Frontiers in Physics (ICNFP), OAC, Kolymbari. Crete, Greece, 10-23 July, 2023. DOI: 10.13140/RG.2.2.14347.67365.

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