
GIQ **29** (2024) 35–44

SERIES ON
Geometry, Integrability and Quantization
ISSN 1314-3247

REPARAMETERIZATION INVARIANCE AND ITS RELATION TO THE DARK MATTER PHENOMENON

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Communicated by Ramon González Calvet

The existence of Dark Matter (DM) is hypothesized as an explanation of the flat rotational curves in galaxies. Modified Newtonian Dynamics (MOND) offers an alternative view. This work introduces the Reparameterization Invariant Scaling Symmetry (RISS) by considering a conformal cosmic scale factor, defined within the Scale Invariant Vacuum (SIV) gauge, that removes the Einstein Cosmological Constant from the corresponding dynamical equations. The paper derives the MOND fundamental relation between the observed gravitational acceleration, the MOND fundamental acceleration, and the Newtonian acceleration of a system. The value obtained for the MOND fundamental acceleration is in the correct order of magnitude as observed in nature.

MSC: 83E99, 83F05, 83D05
Keywords: Dark energy, dark matter, modified newtonian dynamics, reparameterization invariance, scale-invariant vacuum

1. Introduction

Modern physics faces a captivating paradox. Quantum Field Theory (QFT) and General Relativity (GR), the foundation of our understanding of the universe, successfully describe phenomena within the Solar System and on Earth. However, at larger scales encompassing galaxies and the cosmos, models reveal a stark disparity. Ordinary matter, the observable building block of the universe, constitutes only $\approx$ 5% of its energy content. Dark Energy (DE) dominates the total energy with $\approx$ 70%, while DM accounts for $\approx$ 25% as determined by Planck 2015 results.

Numerous proposals exist regarding the nature of DE and DM, including new fields, particles, or modifications and extensions of GR. However, the prevailing explanation for DE and DM has faced a detection deficit for over 40 years.

This work presents a potential resolution to the DM puzzle through a symmetry extension of Einstein GR. While Weyl's 1918 proposal for such an extension was