PRESENTATION BY NICK JULIANO

UGUR CAMCI

ON DARK MATTER AS A GEOMETRIC EFFECT IN THE GALACTIC HALO

INTRODUCTION

- Dark Matter (DM) is the determining factor for the formation of galaxies.
- DM is the proposed explanation for disagreement between “luminous” matter theory and observations.
- Modified gravity models can also account for additional matter unaccounted for in observations.

INTRODUCTION

- To measure the DM EoS in the galactic halo:
  - $f(X)$ is a general function of $X \in \{R, \mathscr{G}, T\}$, where $R, \mathscr{G}, T$ are the Ricci scalar, the Gauss-Bonnet scalar and the torsion scalar, respectively.
  - Flat rotation curves are a consequence of the additional geometric structure.

INTRODUCTION

$$w_X \equiv \frac{p_X}{\rho_X}$$

- DM analog to EoS for baryonic matter
- **Astrophysical consequences arise when considering modified gravity theories**

FLAT ROTATION CURVES IN MODIFIED GRAVITY - $f(R)$

- Derivations in the article demonstrate that density and pressure vanish in the general relativistic (GR) regime.
- In $f(R)$ gravity, GR does not inform the DM dominated region of galaxies.
- The expression for gravitational potential in this form of gravity fails in the Newtonian regime.

FLAT ROTATION CURVES IN MODIFIED GRAVITY - $f(R, \mathcal{G})$

- Derivations in the article demonstrate that $w_{R,\mathcal{G}} = -1$

In this case, the halo should only be filled with phantom energy.

FLAT ROTATION CURVES IN MODIFIED GRAVITY - $f(T)$

- Rotational velocities in this configuration possibly exceed the speed of light.

DISCUSSION

- All modified theories considered in this paper omit any consideration of baryonic matter.
- The results of this analysis hold for both cold and warm dark matter.
- The author of this paper is clearly not a native english speaker, and it’s possible that much of the work was lost in translation.