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REVIEWER'S REPORT

Manuscript No.: IJAR-57946

Title: Performing advance on inflation scenario description through Quadratic Teleparallel model

Recommendation:

Accept as it is

Accept after minor revision.....

Accept after major revision

Do not accept (*Reasons below*)

Rating	Excel.	Good	Fair	Poor
Originality		✓		
Techn. Quality		✓		
Clarity		✓		
Significance		✓		

Reviewer's ID: JPR-130

Detailed Reviewer's Report

Overall Evaluation

This manuscript presents a theoretical study on the role of the quadratic teleparallel gravity model in explaining the inflationary phase of the universe. The authors derive cosmological equations, obtain inflationary observables, and compare the results with observational data from Planck and BICEP2 experiments. The study shows that the proposed model can reproduce the observed values of the spectral index and tensor-to-scalar ratio and can explain the accelerated expansion of the early universe. The topic is relevant and important in modern cosmology. The paper demonstrates strong mathematical work and provides several numerical analyses to support the proposed model. The results indicate that the model is capable of describing inflation consistently with observational constraints. However, the manuscript requires improvements in language, presentation, explanation of physical concepts, and organization. Some sections are highly mathematical with limited physical interpretation, making it difficult for readers to follow the significance of the results. Therefore, major revisions are recommended before publication.

Strengths of the Manuscript

- 1. Important Research Topic** - The study addresses the inflationary evolution of the universe, which is a fundamental problem in cosmology. The use of modified teleparallel gravity provides an alternative perspective to conventional inflationary models.
- 2. Strong Theoretical Framework** - The authors successfully derive the governing equations of the quadratic teleparallel model. The mathematical development is systematic and demonstrates good theoretical understanding.

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3. Comparison with Observations - The model predictions are compared with Planck and BICEP2 observational data. The obtained values of the spectral index and tensor-to-scalar ratio fall within acceptable observational limits.

4. Comprehensive Analysis - The study investigates several important cosmological quantities:

- Scalar field potential
- Slow-roll parameters
- Spectral index
- Tensor-to-scalar ratio
- Comoving Hubble radius
- Energy density
- Pressure
- Equation of state parameter

This provides a detailed understanding of the inflationary behavior of the model.

5. Useful Graphical Results - The figures clearly show the evolution of inflationary parameters. Graphical comparisons with observational data strengthen the credibility of the model.

6. Well-Structured Conclusion - The conclusion summarizes the main findings effectively. The authors clearly state how the model agrees with observational evidence.

Areas for Improvement

1. Language and Grammar - The manuscript contains several grammatical and typographical errors.

Examples include: Incorrect sentence construction. Missing spaces and punctuation. Repetition of phrases. Inconsistent formatting. The paper would benefit greatly from professional English language editing.

2. Clarity of Mathematical Derivations - Although the mathematical treatment is extensive, some derivations are difficult to follow.

Suggestions: Include more intermediate calculation steps. Explain the significance of important equations. Define all variables clearly when first introduced. This would improve readability for a wider scientific audience.

3. Physical Interpretation of Results - The manuscript focuses heavily on mathematical derivations, while the physical meaning of the results is not discussed in sufficient detail. For example: Why does the model fit observational data? What advantages does the quadratic teleparallel model offer over other inflationary models? What are the physical implications of the obtained parameter values? More discussion would improve the scientific impact of the paper.

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4. Parameter Selection - Several numerical values are used in the figures and calculations, but their selection is not fully justified. The authors should: Explain how these parameter values were chosen. Discuss whether other parameter values produce similar results. Include a brief sensitivity analysis if possible.

5. Literature Review - The literature review covers many relevant references but remains largely descriptive. Improvements needed: Highlight the research gap more clearly. Compare the proposed model with recent inflationary models. Explain the novelty of the current work more explicitly.

6. Figures and Presentation - The figures are useful but can be improved. Suggestions: Increase figure clarity and resolution. Improve figure captions. Explain the physical significance of each figure in greater detail.

7. Discussion of Limitations - The manuscript mainly focuses on positive results. The authors should also discuss: Limitations of the model. Assumptions used in the analysis. Possible challenges in applying the model to other cosmological scenarios.

8. Future Research Directions - The paper would be strengthened by including possible future extensions such as: Testing the model against additional observational datasets. Studying reheating processes in greater detail. Extending the framework to other modified gravity theories.