



### REVIEWER'S REPORT

**Manuscript No.: IJAR- 57946**

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

**Recommendation:**

**Accept after minor revision.**

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

**Reviewer Name: Dr. Bishwajit Rout**

**Reviewer's Comment for Publication.**

*(To be published with the manuscript in the journal)*

*The reviewer is requested to provide a brief comment (3-4 lines) highlighting the significance, strengths, or key insights of the manuscript. This comment will be Displayed in the journal publication alongside with the reviewers name.*

- Significance:** This study is significant because it develops and evaluates an inflationary scenario within quadratic teleparallel gravity using a quintessence scalar field and observational constraints. The work contributes to modified gravity cosmology by connecting analytical model construction with inflationary observables, cosmological evolution, and inflation exit conditions. Its integration of theoretical reconstruction and observational consistency offers valuable insight into alternative descriptions of early-universe dynamics.
- Strength:** The principal strength of the manuscript lies in combining analytical derivations, scalar-field reconstruction, inflationary observables, and cosmological evolution within a unified modified gravity framework. The study attempts to connect theoretical predictions with observational constraints and includes both qualitative and numerical analyses. Investigation of the comoving Hubble radius and equation-of-state evolution provides additional physical support for the proposed inflationary scenario.
- Key Insight:** The most important insight is that the quadratic teleparallel model with a quintessence scalar field can simultaneously produce observationally acceptable inflationary observables and exhibit physically meaningful inflationary evolution. The decreasing comoving Hubble radius, declining scalar potential, and equation-of-state behaviour collectively indicate accelerated expansion with an inflation exit mechanism, suggesting that modified teleparallel gravity remains a viable framework for early-universe cosmology.

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### *Reviewer's Comment / Report*

The paper titled "*Performing advance on inflation scenario description through Quadratic Teleparallel model.*" investigates inflationary cosmology using a quadratic teleparallel  $f(T)$  gravity model coupled to a scalar field. It derives motion equations, slow-roll parameters, and key observables (spectral index  $n_s$  and tensor-to-scalar ratio  $r$ ), successfully matching Planck and BICEP2 data. The model features rapid decrease in the comoving Hubble radius, negative equation-of-state parameter (quintessence-like), decreasing scalar potential, and a graceful exit to reheating. A mathematically rigorous contribution to modified gravity inflation scenarios, though limited to analytical/numerical consistency checks.

#### **Suggestions for Improvement:**

1. Clarify unresolved limitations within existing inflationary studies.
2. Compare quadratic teleparallel inflation more critically against established  $f(R)$  and scalar-field scenarios.
3. Explain why observational reconstruction offers advantages over conventional inflationary modelling approaches.
4. Explain physical interpretation of torsion and teleparallel modifications with stronger conceptual clarity.
5. Include assumptions and parameter restrictions governing validity of derived cosmological equations.
6. Demonstrate derivation steps leading from field equations to analytical Hubble parameter solutions.
7. Clarify physical meaning of integration constants and their cosmological interpretations consistently.
8. Include confidence intervals and numerical bounds supporting agreement with observational constraints.
9. Quantify statistical agreement with Planck observational bands.
10. Discuss compatibility with recent observational constraints beyond Planck and BICEP2 datasets.
11. Compare obtained equation-of-state evolution with contemporary dark-energy phenomenological models.

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The manuscript addresses an interesting and contemporary problem in modified gravity and inflationary cosmology and presents promising analytical results. However, publication requires substantial revision in mathematical exposition, derivation transparency, observational validation, numerical reproducibility, and scientific discussion. The paper should strengthen parameter justification, improve comparison with contemporary observational constraints, clarify assumptions, and expand discussion of limitations and physical implications to achieve stronger scientific rigor and publication readiness. Addressing the identified weaknesses will make it suitable for publication in IJAR.

I recommend this paper for publication after minor revision.