



Formal Comment on “Quantum Fundamental Speed Theory: Mathematical Derivations of Dark Matter and Dark Energy from the Speed Field”

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1. EXECUTIVE SUMMARY

This paper presents a critical analysis of “Quantum Fundamental Speed Theory: Mathematical Derivations of Dark Matter and Dark Energy from the Speed Field” (JAST, Vol.4, No.7, 2026). The theory claims to explain dark matter and dark energy via a “fundamental speed field” and is the third in a series of papers, the primary references [1] and [3] being non-peer-reviewed preprints.

The paper claims five principal results:

1. **Dark Matter:** Quantum particles with mass 3.88×10^{-24} eV, derived “without free parameters” from a classical screening length of 1.647 pc.
2. **Dark Energy:** Vacuum energy density from a logarithmic potential, with a normalized field value $\tilde{v}_{\text{now}} = 8.21 \times 10^{-12}$.
3. **Unification:** Dark matter and dark energy emerge from the same vector field.
4. **Galactic Rotation Curves:** Fits 171 SPARC galaxies without dark matter, with $\chi^2 = 0.170$.
5. **No Free Parameters:** All parameters are “fixed by galaxy physics”.

This analysis demonstrates that **every single one of these claims is false**. The paper suffers from eleven major issues, nine of which are independently fatal.

2. SCIENTIFIC CONTEXT AND JOURNAL POLICY

The paper is published in JAST (Sana'a University Journal of Applied Sciences and Technology), a multidisciplinary journal. According to the journal's policy, all references

#	Issue	Ruling
1	Lagrangian incomplete: missing $\lambda\phi^4$ term; λ unexplained	Fatal
2	β_{eff} cannot originate from the logarithmic potential (7 orders of magnitude difference)	Fatal
3	Eq. (24) diverges at finite radius	Fatal
4	FST does not solve Einstein's equations	Fatal
5	FST is not a modified gravity theory (worse than MOND)	Fatal
6	L_0 is a free parameter; dark energy density $\propto 1/L_0^2$ unjustified	Fatal
7	FST fails the criteria of a physical theory; not reproducible	Fatal
8	$\chi^2_\nu = 0.170$ is statistically impossible ($P \sim 10^{-284}$)	Warning
9	Three ghosts in the quantum sector (ADM + Dirac–Bergmann analysis)	Fatal
10	Violation of journal citation policy (non-peer-reviewed references)	Methodological Warning
11	No valid scientific result	Fatal

must be from recognized, peer-reviewed scientific journals; non-peer-reviewed sources are not accepted. However, the paper relies primarily on two non-peer-reviewed preprints as foundational references [1, 3], constituting a clear violation. This weakens the scientific basis of the theory.

3. SUMMARY OF THE CLASSICAL FST

3.1. BASIC ACTION

The paper presents the action in Eq. (7):

$$S = \int d^4x \sqrt{-g} \left[\frac{c^4}{16\pi G} R + V(\nu, \nabla\nu) + m \right] \quad (1)$$

3.2. VECTOR FIELD LAGRANGIAN

Eqs. (8-9):

$$V = \frac{c^4}{16\pi GL_0^2} \left(-\frac{1}{2}K - V(\tilde{\nu}) \right) \quad (2)$$

$$K = c_1 L_0^2 (\nabla_\mu \nu_\nu) (\nabla^\mu \nu^\nu) + c_2 L_0^2 (\nabla_\mu \nu^\mu)^2 + c_3 L_0^2 (\nabla_\mu \nu_\nu) (\nabla^\nu \nu^\mu) \quad (3)$$

3.3. LOGARITHMIC POTENTIAL

Eq. (10):

$$V(\tilde{\nu}) = -V_0 \ln \left(1 + \frac{\tilde{\nu}^2}{\nu_0^2} \right), \quad V_0 = \frac{c_1}{2} \nu_0^6 \quad (4)$$

3.4. PARAMETERS (TABLE 7 OF THE PAPER)

Constant	Symbol	Value
Speed of light	c	2.9979×10^8 m/s
Reduced Planck constant	$\hbar$	1.0546×10^{-34} J·s
Gravitational constant	G	6.6743×10^{-11} m ³ /kg·s ²
Galactic scale	L_0	3.0857×10^{20} m (10 kpc)
Screening length	λ_{screen}	5.082×10^{16} m (1.647 pc)
Asymptotic field value	ν_0	0.911×10^{-3}
Effective coupling	β_{eff}	2.0×10^7
Kinetic coefficients	(c_1, c_2, c_3)	(0.51, -0.07, 0.32)
Self-coupling	λ	7.37×10^{13}

Crucial note: $\nu_0 = 0.911 \times 10^{-3}$ is the ratio of a characteristic galaxy speed (~ 249 km/s) to the speed of light—a systemic property, not a fundamental constant. λ appears in Table 7 with no derivation from any equation in the paper.

4. ISSUE 1: THE LAGRANGIAN IS INCOMPLETE — MISSING $\lambda\phi^4$ TERM (FATAL)

4.1. LOCATION OF THE DEFECT

The Lagrangian in Eq. (8) contains only the logarithmic potential $V(\tilde{\nu})$. However, the central field equation (Eq. 33) contains:

$$\frac{\lambda}{6} (\nu_\alpha \nu^\alpha) \nu^\nu \quad (5)$$

This term originates from a potential $V_\lambda \propto (\nu_\alpha \nu^\alpha)^2$, which is **absent** from V .

4.2. PROOF OF FUNCTIONAL INCOMPATIBILITY

The variation of the logarithmic potential $V = -V_0 \ln(1 - X/\nu_0^2)$ with $X \equiv \nu_\alpha \nu^\alpha$ yields:

$$\frac{\delta V}{\delta \nu^\nu} = \frac{2V_0}{\nu_0^2} \cdot \frac{\nu_\nu}{1 - \nu_\alpha \nu^\alpha / \nu_0^2} \quad (6)$$

The required term $(\lambda/6)(\nu_\alpha \nu^\alpha) \nu_\nu$ comes from $V_\lambda = (\lambda/12)(\nu_\alpha \nu^\alpha)^2$, giving:

$$\frac{\delta V_\lambda}{\delta \nu^\nu} = \frac{\lambda}{3} (\nu_\alpha \nu^\alpha) \nu_\nu \quad (7)$$

Equating these implies an algebraic equation for X , not a functional identity. They are **functionally irreconcilable**.

4.3. CONCLUSION

Equation (33) cannot be derived from the given Lagrangian. λ —the ultimate source of V_0 , and ρ_Λ —has no origin in V . The entire theoretical edifice rests on a parameter absent from the action.

5. ISSUE 2: β_{EFF} CANNOT ORIGINATE FROM THE LOGARITHMIC POTENTIAL (FATAL)

5.1. NUMERICAL VERIFICATION

Using values from Table 7: $\beta_{\text{eff}} = \frac{|\lambda| \nu_0^2}{6c_1} = 2.00 \times 10^7$. This confirms that λ is the true source of β_{eff} .

5.2. FORCE DISCREPANCY

At $\tilde{\nu} = 1$, the force from the logarithmic potential is:

$$F_{\log} = \frac{1}{1 - (-\nu_0^2)/\nu_0^2} = \frac{1}{2} = 0.5 \quad (8)$$

The force required by Eq. (24) is:

$$F_{\text{eq}} = \beta_{\text{eff}} \tilde{\nu}^3 = 2.0 \times 10^7 \quad (9)$$

The ratio is $F_{\text{eq}}/F_{\log} = 4.0 \times 10^7$ — **seven orders of magnitude difference**.

5.3. CONCLUSION

The logarithmic potential cannot produce the force required in Eq. (24). The true β_{eff} comes from the unexplained parameter λ , confirming Issue 1.

6. ISSUE 3: EQUATION (24) DIVERGES AT FINITE RADIUS (FATAL)

6.1. MATHEMATICAL PROOF

Transform Eq. (24): $y = \tilde{\nu}$, $x = \sqrt{\beta_{\text{eff}}} \xi$.

$$\frac{d^2 y}{dx^2} + \frac{2}{x} \frac{dy}{dx} = y^3 \quad (10)$$



Rewrite as $(x^2 y')' = x^2 y^3$. Integrating:

$$x^2 y'(x) = \int_0^x t^2 y(t)^3 dt > 0 \quad \forall x > 0 \quad (11)$$

Thus $y'(x) > 0$ for all $x > 0$; the solution is strictly monotonic increasing.

6.2. PROOF OF FINITE-DISTANCE BLOW-UP

Let $z(x)$ be the solution of $z'' = z^3$ with $z(0) = y(0)$, $z'(0) = 0$. The exact solution is:

$$z(x) = \frac{\sqrt{2}y(0)}{\sqrt{2 - y(0)^2 x^2}} \quad (12)$$

which diverges at $x_c = \sqrt{2}/y(0)$. From the original equation, $y'' = y^3 - (2/x)y'$. Since $-(2/x)y' < 0$, we have $y'' < y^3$, but this deceleration is insufficient to prevent blow-up. By a comparison theorem, $y(x)$ also diverges at a finite x .

6.3. PHYSICAL CONSEQUENCES

The field diverges to infinity at a finite radius from the galaxy center—this is non-physical. Flat rotation curves require an acceleration decreasing as $1/r$, not a divergent solution.

6.4. CONCLUSION

Eq. (24) is mathematically proven to diverge at finite r and cannot describe flat galactic rotation curves.

7. ISSUE 4: FST DOES NOT SOLVE EINSTEIN'S EQUATIONS (FATAL)

7.1. THEORETICAL ANALYSIS

The action (7) contains R , making the metric dynamical. Variation with respect to $g^{\mu\nu}$ must yield:

$$G_{\mu\nu} = \frac{8\pi G}{c^4} \left(T_{\mu\nu}^{(m)} + T_{\mu\nu}^{(\nu)} \right) \quad (13)$$

The paper ignores these equations entirely. The metric is treated as a fixed Minkowski background, not a dynamical field. Ricci commutators $([\nabla_\mu, \nabla_\nu]\nu^\alpha = R^\alpha_{\beta\mu\nu}\nu^\beta)$ are neglected, meaning curvature corrections in the field equation are absent.

7.2. CONSEQUENCES OF IGNORING EINSTEIN'S EQUATIONS

- **Gravitational Waves:** Cannot be calculated; GW170817 constraints cannot be tested.
- **Gravitational Lensing:** Deflection angles cannot be computed.
- **CMB:** The Sachs-Wolfe effect cannot be analyzed.
- **Solar System:** PPN parameters $(\beta^{\text{PPN}}, \gamma^{\text{PPN}})$ cannot be calculated; Cassini constraint $\gamma^{\text{PPN}} - 1 < 2.3 \times 10^{-5}$ cannot be verified.

- **Equivalence Principle:** Cannot test weak or strong equivalence principles.

7.3. CONCLUSION

FST is a field theory on a non-dynamical background, not a modified gravity theory.

8. ISSUE 5: FST IS NOT A MODIFIED GRAVITY THEORY (FATAL)

8.1. COMPARATIVE ANALYSIS

In GR, the Newtonian potential Φ and gravitational acceleration a are derived from the metric: $a = v^2/r = |\nabla\Phi|$. FST assumes $a \propto \tilde{v}^2$ with no derivation of the relationship between $\tilde{v}$ and g_{00} . In Brans-Dicke theory, the scalar field couples to curvature:

$$R_{\mu\nu} - \frac{1}{2}g_{\mu\nu}R = \frac{8\pi}{\phi}T_{\mu\nu} + (\text{scalar terms}) \quad (14)$$

FST contains no such coupling.

8.2. COMPARISON WITH MOND

Criterion	MOND	FST
Free parameters	1 (a_0)	6 ($c_1, c_2, c_3, \beta_{\text{eff}}, \nu_0, L_0$)
Theoretical basis	Modified Newtonian dynamics	Extra field on fixed background
Falsifiability	High	Low (no Einstein equations)
Parameter economy	Excellent	Poor

8.3. CONCLUSION

FST is a phenomenological recipe, not a fundamental modified gravity theory. It requires 6 free parameters versus 1 for MOND.

9. ISSUE 6: L_0 IS AN UNJUSTIFIED FREE PARAMETER (FATAL)

9.1. ANALYSIS OF DEPENDENCE ON L_0

The paper claims “no free parameters,” but:

- $L_0 = 10$ kpc was chosen arbitrarily.
- All “predictions” depend on L_0 :
 - Dark matter mass: $m \propto 1/L_0$
 - Dark energy density: $\rho_\Lambda \propto 1/L_0^2$
 - Screening length: $\lambda_{\text{screen}} \propto L_0$
- The relation $\rho_\Lambda \propto 1/L_0^2$ ties the cosmological constant to a galactic scale with no physical justification.

9.2. CONCLUSION

All “predictions” are controlled by an arbitrary choice of L_0 . The theory makes no genuine predictions.

10. ISSUE 7: FST FAILS THE CRITERIA OF A PHYSICAL THEORY (FATAL)

A valid physical theory must be:

1. **Reproducible:** Independent researchers can derive the same results.
2. **Falsifiable:** Makes testable predictions.
3. **Mathematically Consistent:** Free of internal contradictions.

Criterion	Status in FST	Ref
Reproducibility	Lagrangian incomplete; cannot re-derive	Issue 1
Falsifiability	No Einstein equations; no testable predictions	Issue 4
Mathematical consistency	Non-physical equation; quantum ghosts	Issues 3, 9

10.1. CONCLUSION

This is not a scientific theory in the strict sense.

11. ISSUE 8: $\chi^2_\nu = 0.170$ IS STATISTICALLY IMPOSSIBLE (WARNING)

11.1. STATISTICAL ANALYSIS

The paper claims a fit to 171 SPARC galaxies with $\chi^2_\nu = 0.170$. The definition is:

$$\chi^2_\nu = \frac{1}{N-p} \sum_i \frac{(v_{\text{obs},i} - v_{\text{model},i})^2}{\sigma_i^2} \quad (15)$$

For $N = 171$, $\chi^2_\nu = 0.170$ implies $\chi^2 = 29.07$ (assuming $p = 0$). For a χ^2 distribution with 171 degrees of freedom:

$$P(\chi^2 \leq 29.07 \mid \nu = 171) \approx 10^{-284} \quad (16)$$

This probability is vanishingly small.

11.2. POSSIBLE INTERPRETATIONS

Either:

1. A computational error: χ^2_ν is grossly overestimated (underestimated by a factor ~ 6 , true value ~ 6.1).
2. Severe overfitting: using ~ 177 parameters for 171 galaxies.

11.3. CONCLUSION

The sole quantitative evidence for FST is statistically unreliable.

12. ISSUE 9: THREE GHOSTS IN THE QUANTUM SECTOR (FATAL)

12.1. ADM DECOMPOSITION

Metric: $ds^2 = -N^2 dt^2 + h_{ij}(dx^i + N^i dt)(dx^j + N^j dt)$.
Vector field decomposition:

$$\nu_\mu = -\nu_\perp n_\mu + \nu_\mu^\parallel \quad (17)$$

where $\nu_\perp = n^\mu \nu_\mu$ (scalar), $\nu_\mu^\parallel = h^\nu_\mu \nu_\nu$ (spatial vector).

12.2. KINETIC MATRIX

Computing the kinetic terms from the Lagrangian:

$$\mathcal{L}_{\text{time}} = \frac{c^4}{16\pi G} \frac{\sqrt{h}}{N} \cdot \frac{1}{2} \left[(c_1 + c_2 + c_3) \dot{\nu}_\perp^2 - (c_1 + c_3) \dot{\nu}_i^\parallel \dot{\nu}_i^\parallel \right] \quad (18)$$

12.3. KINETIC MATRIX AND EIGENVALUES

$$M = \text{diag}(c_1 + c_2 + c_3, -(c_1 + c_3), -(c_1 + c_3), -(c_1 + c_3)) \quad (19)$$

Eigenvalues: $(+, -, -, -)$. With $c_1 = 0.51$, $c_3 = 0.32$:

- $1/(2(c_1 + c_2 + c_3)) = 0.658 > 0$: $\nu_\perp$ is healthy.
- $-1/(2(c_1 + c_3)) = -0.602 < 0$: $\nu_i^\parallel$ are ghosts.

12.4. PHYSICAL CONSEQUENCES OF GHOSTS

- **Vacuum instability:** $\Gamma \propto \Lambda^4$, $\tau \sim 10^{-43}$ s — contradicts the 13.8 Gyr age of the universe.
- **Non-unitarity:** Probability conservation violated.
- **Breakdown of perturbation theory:** Incorrect sign in propagator.

12.5. WHY NO PROTECTION MECHANISM

Einstein-Aether theory imposes $u_\mu u^\mu = -1$ via a Lagrange multiplier, which removes the ghost. FST explicitly does *not* impose this constraint, losing the protection mechanism.

12.6. CONCLUSION

Consistent quantization is impossible. All quantum results are invalid.

13. ISSUE 10: VIOLATION OF JOURNAL CITATION POLICY (METHODOLOGICAL WARNING)

JAST policy requires all references to be from recognized, peer-reviewed journals. The paper relies fundamentally on non-peer-reviewed preprints [1] and [3], violating this policy.

14. ISSUE 11: NO VALID SCIENTIFIC RESULT (FATAL)



Claim	Section	Status
"FST is a modified gravity theory"	§3	No Einstein eqs.; incomplete Lagrangian
"Canonical quantization"	§4	3 ghosts
"Dark matter from FST quanta"	§5-8	Mass from incomplete Lagrangian
"Dark energy from logarithmic potential"	§9	L_0 is free; $\rho_\Lambda \propto 1/L_0^2$
"No free parameters"	§12	6 free cosmic parameters
$\chi^2_\nu = 0.170$	§2	Statistically impossible

Not a single claim in this paper is correct.

15. FINAL CONCLUSION AND RECOMMENDATION

15.1. SUMMARY OF ISSUES

Nine of the eleven identified issues are independently fatal. Even if the Lagrangian were repaired (adding $\lambda\phi^4$), the following remain fatal:

- Quantum ghosts (Issue 9)
- Failure to solve Einstein's equations (Issue 4)
- Non-physical field equation (Issue 3)
- Dependence on arbitrary L_0 (Issue 6)

15.2. RECOMMENDATIONS FOR THE AUTHOR

Should the author wish to pursue this line of inquiry, the following are minimal requirements:

1. Add $\lambda(\nu_\alpha\nu^\alpha)^2$ to V with a physical derivation of λ .
2. Reformulate Eq. (24) to produce physically realistic solutions.
3. Solve Einstein's equations with $T_{\mu\nu}^{(\nu)}$.
4. Add the unit constraint $\nu_\mu\nu^\mu = -1$ to remove ghosts, as in Einstein-Aether theory.
5. Recalculate using standard statistical methods.
6. Cite only peer-reviewed sources.

15.3. FINAL RECOMMENDATION

The paper is **unsuitable for scientific publication** and its conclusions are unreliable. I recommend its **unconditional rejection**.

REFERENCES

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APPENDIX: SYMBOLS AND ABBREVIATIONS

Symbol	Meaning	Symbol	Meaning
$g_{\mu\nu}$	Spacetime metric	ν_{μ}	Speed field
R	Ricci scalar	$\tilde{\nu}$	Normalized field (ν/ν_0)
∇_{μ}	Covariant derivative	ν_0	Asymptotic value (0.911×10^{-3})
$G_{\mu\nu}$	Einstein tensor	L_0	Galactic scale (10 kpc)
N, N^i	Lapse and shift	λ_{screen}	Screening length (1.647 pc)
h_{ij}	3-metric	β_{eff}	Effective coupling (2.0×10^7)
K_{ij}	Extrinsic curvature	c_1, c_2, c_3	Kinetic coefficients
n_{μ}	Unit normal ($n_{\mu}n^{\mu} = -1$)	λ	Self-coupling (7.37×10^{13})
$\nu_{\perp}$	Normal component (scalar)	Π	Conjugate momentum
$\nu_{\parallel}^i$	Spatial components (vector)	$H_{\perp}, H_i$	Hamiltonian/momentum constraints

Abbreviations

ADM	Arnold-Deser-Misner	AE	Einstein-Aether
CMB	Cosmic Microwave Background	DOF	Degrees of Freedom
GR	General Relativity	MOND	Modified Newtonian Dynamics
PPN	Parameterized Post-Newtonian	QFT	Quantum Field Theory
SPARC	Spitzer Photometry and Accurate Rotation Curves		