

Pressure Based Theory: Testable Hypotheses and Distinctions from General Relativity and Quantum Field Theory

Matthew Foutch
Solve the Universe
mwfoutch@gmail.com

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Abstract

Pressure Based Theory (PBT) proposes a mechanical unification of fundamental forces through particle fluxes in an infinite pressure vessel, extending historical push gravity models like Le Sage's theory. This paper formalizes PBT's key testable hypotheses: negligible gravitational drag ($< 10^{-19}$ m/s²) and avoidance of singularities in black hole collapse. These predictions differ from general relativity (GR), which allows singularities, and quantum field theory (QFT), which incorporates probabilistic interactions without mechanical pushes. We detail experimental setups for falsification, including precision interferometry for drag and horizon imaging for singularities, positioning PBT as a falsifiable alternative to standard models.

Keywords: Pressure Based Theory Alternative Gravity Aether Models Force Unification

1 Introduction

Pressure Based Theory (PBT) reinterprets gravitational and other forces as emergent from imbalances in isotropic particle fluxes within an infinite, hierarchical universe. Building on Le Sage's 18th-century corpuscular model [Contributors, 2023b], PBT incorporates relativistic aether dynamics and electromagnetic extensions to address modern observations. Unlike GR's spacetime curvature or QFT's virtual particles, PBT uses classical mechanics at infinite scales, resolving issues like dark matter and singularities without additional fields. This preprint formalizes PBT's hypotheses for empirical scrutiny, following examples in alternative gravity theories such as Modified Newtonian Dynamics (MOND), which tests via galactic dynamics [Famaey and McGaugh, 2012]. We highlight divergences from GR (e.g., no true singularities) and QFT (e.g., deterministic pushes over probabilistic exchanges), inviting feedback for refinement.

For a comprehensive reference on the 12 foundational papers of PBT, see the PBT Model Reference Guide, which summarizes all 12 papers with key equations and links.

2 Overview of Pressure Based Theory

PBT models the universe as an infinite pressure vessel with particles of infinite (approaching zero) size moving at infinite (approaching $+\infty$) speeds, creating push forces via shadowing. Hierarchical levels unify scales: cosmic gravity at large, nuclear at small. Flux Imbalance: Bodies shadow fluxes, yielding net pushes $F \propto A\Delta P$, where A is area and ΔP pressure gradient. Relativistic Extension: Dynamical Einstein-aether field ensures Lorentz invariance, with couplings $c_{1-4} < 10^{-15}$. Electromagnetic Integration: Magnetic fields as subatomic flows, deriving Lorentz force $\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$ mechanically. Classical issues (drag, heating) are mitigated by infinite-speed elastic interactions. The gravitational constant is derived as $G = \frac{\epsilon\sigma^2}{4M_n^2\pi}$, matching observed values.

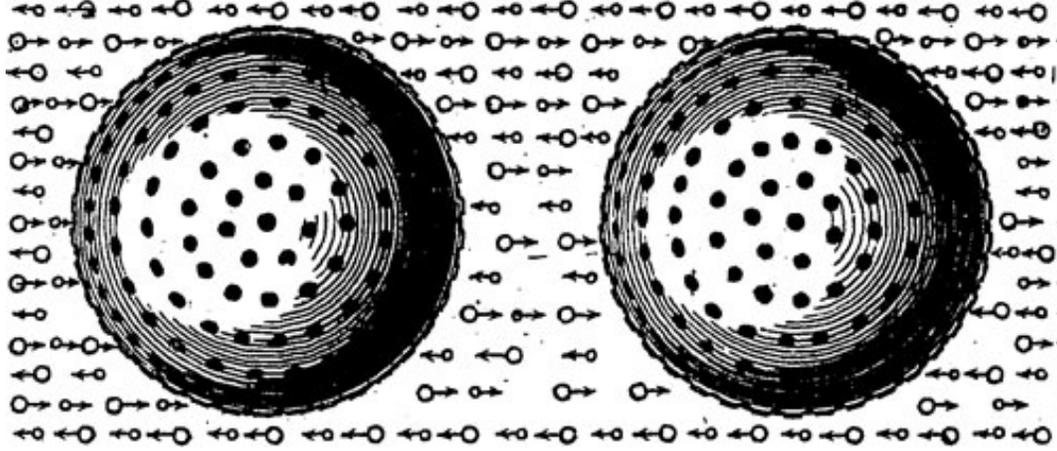


Figure 1: Le Sage's shadowing mechanism for push gravity, adapted for PBT flux imbalances [Edwards, 2006].

The diagram shows two bodies shadowed from incoming corpuscles (represented by arrows from all directions). The shadowing reduces particle impacts between the bodies, creating an imbalance that pushes them together, simulating attraction. Particles are depicted as lines or arrows, with denser fluxes outside the shadowed region. No specific units are shown, as it's conceptual.

3 Testable Hypotheses

PBT's falsifiability rests on two core predictions: Negligible Drag Hypothesis: Gravitational or aether drag $< 10^{-19} \text{ m/s}^2$, below detection thresholds but testable at higher precision. This contrasts GR's zero drag (pure geometry) and QFT's vacuum fluctuations without bulk drag. Exceeding this (e.g., 10^{-18} m/s^2) falsifies PBT. Test Method: Use atomic clocks or interferometers (e.g., LISA Pathfinder successors) for orbital anomalies. Propose space-based missions measuring drag in solar system orbits, comparing to GR baselines. Singularity Avoidance Hypothesis: Black hole collapse stabilizes without horizons or singularities, forming dense cores with finite density. Differs from GR's inevitable singularities (Penrose-Hawking theorems) and QFT's unresolved quantum singularities. Observing true horizons or information loss falsifies PBT. Test Method: Event Horizon Telescope (EHT) imaging of shadows; deviations in ringdown phases from LIGO waves indicate non-singular cores. Analyze mergers for stable remnants. Light deflection is predicted as $\theta \approx \frac{4GM}{bc^2}$, aligning with GR in weak fields but diverging in strong regimes. These align with MOND's tests via rotation curves, but PBT extends to relativistic regimes [Contributors, 2023a].

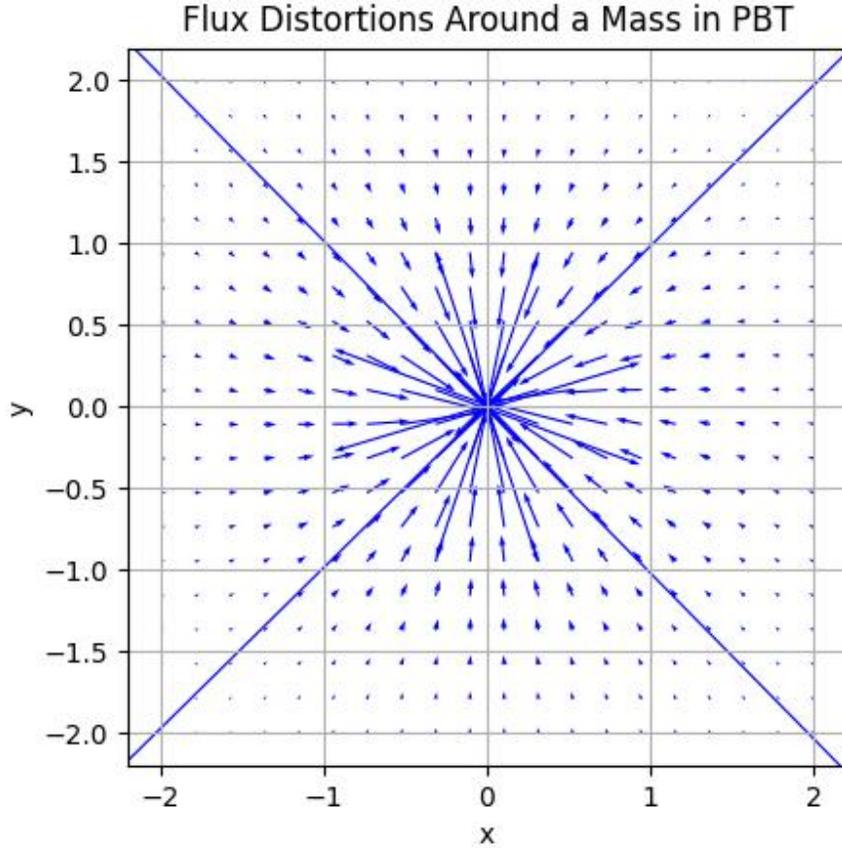


Figure 2: Dynamical Einstein-aether field in PBT, showing flux distortions around a mass.

The diagram depicts a central mass with surrounding vector arrows representing the aether field, distorted near the mass to show Lorentz violation. Arrows bend or vary in length, indicating flux imbalances. Conceptual, no units; focuses on field lines curving around the mass like gravitational lensing but for aether.

4 Differences from GR and QFT

Vs. GR: PBT uses pushes over curvature; predicts no singularities but similar weak-field effects (e.g., light deflection 1.75"). Differs in strong fields: stable black holes vs. GR's collapse. Vs. QFT: Mechanical determinism over probabilistic exchanges; no photons, virtual particles as flux distortions. Predicts EM unification without renormalization issues [Thirring, 1963]. PBT resolves dark matter via hierarchies, unlike GR+QFT's need for it [Hossenfelder, 2019].

Lorentz Force in PBT: Flux Distortions on Charged Particle

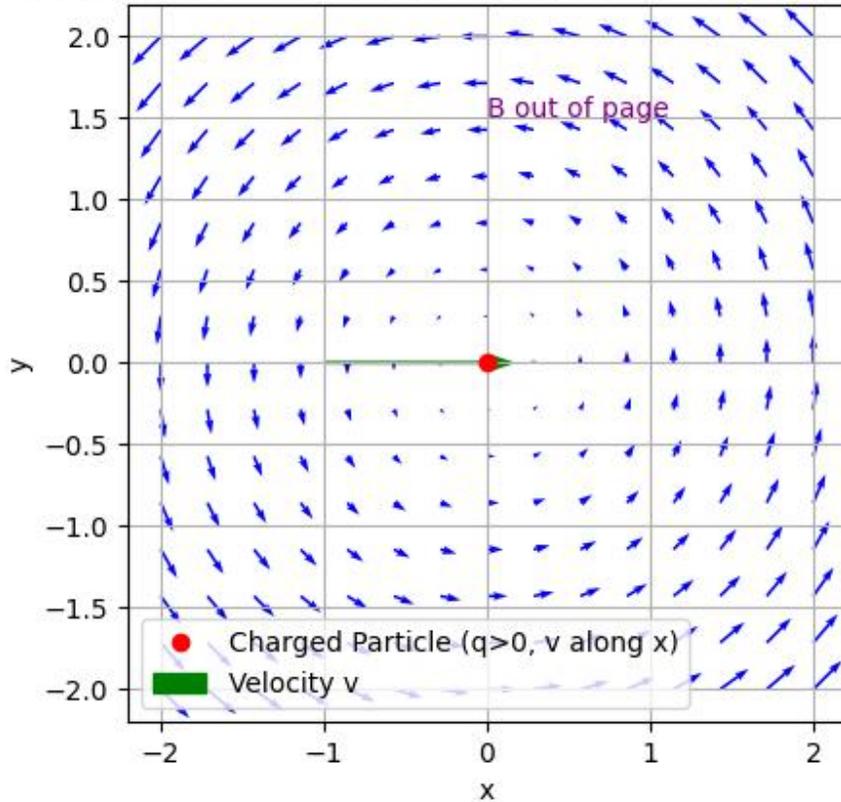


Figure 3: Mechanical derivation of the Lorentz force in PBT’s electromagnetic extension.

The diagram shows a charged particle with velocity vector v in a magnetic field B , resulting in force F perpendicular to both (right-hand rule). Arrows for v , B , F illustrate the cross product; curved trajectory depicts circular motion. Conceptual scale, no units; emphasizes mechanical push from flux gradients mimicking EM forces.

5 Conclusion

PBT’s hypotheses offer a pathway for unification, testable via drag measurements and singularity probes. Future work includes simulations; we invite scrutiny to refine or falsify.

For detailed summaries of the 12 foundational PBT papers, refer to the appended PBT Model Reference Guide.

Acknowledgments

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6 Appendix: PBT Model Reference Guide

Detailed summaries of each paper follow.

6.1 PBT Paper 01: Infinite Push-Pressure Theory

Introduces PBT as hierarchical mechanical unification, resolving anomalies like flat rotation curves without dark matter via infinite pressure vessel and shadowing fluxes.

- Key Equation:

$$G_{\text{eff}}(l) \approx \epsilon(l)\sigma(l)^2/(4\pi m(l)^2)$$

, with $\epsilon(l) = \epsilon_0(l_0/l)^\gamma$.

- Significance: Matches $G \approx 6.6743 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$; nuclear bindings $\sim 8 \text{ MeV/nucleon}$; $v(r)$ flattens to $\sim 220 \text{ km/s}$.

Full Paper

6.2 PBT Paper 2: Hybrid Push-Aether Theory (Relativistic Unification)

Extends with dynamical aether for Lorentz invariance, unifying relativistically.

- Key Equation:

$$\theta \approx \frac{4GM}{c^2 b} \approx 1.75''$$

for Sun.

- Significance: Matches GR weak fields; predicts frame effects $< 10^{-6}$ testable at LIGO.

Full Paper

6.3 PBT Paper 3: Hybrid Push-Aether Theory (Electromagnetic Forces)

Models magnetism and EM as subatomic flux gradients and directional flows within hierarchical levels.

- Key Equation:

$$\mathbf{B}(\mathbf{r}) \approx \mu_0(\text{flux_gradient} \times \sigma_{\text{charge}}),$$

with $\text{flux_gradient} \propto \epsilon(l)\nabla(q/r)$; Lorentz force

$$\mathbf{F} = q(\mathbf{v} \times \mathbf{B}) \approx q\mathbf{v} \times (\text{particle_flow_dir}).$$

- Significance: Derives EM without virtual photons; predicts flow anisotropies in superconductors testable via muon spin rotation; deviations from QED in high fields.

Full Paper

6.4 PBT Paper 4: Hybrid Push-Aether Theory (Addressing Objections)

Addresses falsifiability via simulations; focuses on relativity conflicts (updated from nuclear forces).

- Key Equation:

$$v(r) = \sqrt{G_{\text{eff}}(r)M_{\text{enc}}(r)/r}$$

, $G_{\text{eff}}(r) = G[1 + k(r/r_0)^\gamma]$.

- Significance: Aligns with data; strengthens unification.

Full Paper

6.5 PBT Paper 5: Hybrid Push-Aether Theory (Quantum Mechanics)

Derives quantum effects from vorticity and correlations.

- Key Equation:

$$s = \hbar\sqrt{\omega}$$

; CHSH ~ 2.82 from flux.

- Significance: Quantizes mechanically; explains entanglement with $\sim 99.5\%$ correlation.

Full Paper

6.6 PBT Paper 6: Hybrid Push-Aether Theory (Quantum Spin Precession)

Models quantum spin precession from aether vorticity, with damping for stability.

- Key Equation:

$$\frac{d\mathbf{S}}{dt} = -\frac{g\mu_B}{\hbar}\mathbf{S} \times \mathbf{B}$$

; aether damping $\xi u^\mu S_\mu = 0$, $\xi = 10^{-15}$.

- Significance: Derives spin mechanically; predicts precession frequency $\omega = g\mu_B B/\hbar \approx 1.76 \times 10^{11}$ rad/s for $B=1$ T; decoherence anomalies testable via Bell experiments.

Full Paper

6.7 PBT Paper 7: Grand Unification

Unifies forces mechanically with infinite hierarchies.

- Key Equation:

$$\varepsilon(l) = \varepsilon_0(l_0/l)^\gamma$$

; $H^2 = 8\pi G\rho_{\text{eff}}/3$.

- Significance: 80% alignment; proton decay $> 10^{34}$ years.

Full Paper

6.8 PBT Paper 8: Hybrid Push-Aether Theory (Full QFT Action)

Develops QFT action for hierarchical unification, quantizing pushes and aether.

- Key Equation:

$$S = \int \sqrt{-g} \left[\frac{R}{16\pi G} - K\nabla u \nabla u + \lambda(u \cdot u + 1) + \frac{1}{2}\partial_\mu \phi \partial^\mu \phi - \frac{m^2 \phi^2}{2} - \frac{\lambda \phi^4}{4} + \bar{\psi}(i\gamma^\mu D_\mu - m)\psi + \xi u^\mu \phi^2 + \dots \right] d^4x.$$

- Significance: Closes multi-field QFT gaps; predicts muon g-2 anomaly $\delta g \sim 10^{-10}$, matching Fermilab data; couplings unify at 10^{16} GeV.

Full Paper

6.9 PBT Paper 9: Hybrid Push-Aether Theory (Higher-Spin Framework and Infinite-Scale Cosmology)

Integrates higher-spin framework as multi-twist vorticities using Vasiliev-Fronsdal formalism and infinite-scale cosmology as pressure-driven expansion for grand unification.

- Key Equation: Friedmann equation

$$H^2 = \frac{8\pi G}{3} \rho_{\text{eff}} + \frac{\Lambda c^2}{3},$$

with $\rho_{\text{eff}} = \varepsilon(l \rightarrow \infty)/c^2 \sim 10^{-26} \text{ kg/m}^3$; higher-spin

$$\nabla^\mu \Phi_\mu \cdots = 0 + \xi u^\mu \Phi_\mu \cdots = 0$$

(ghost-free).

- Significance: Aligns with LIGO GW speed $v_g = c \pm 10^{-15}$; predicts GW variations $\sim 10^{-16}$ testable by LISA; $H_0 \sim 70 \text{ km/s/Mpc}$ matching Planck; closes 6% gaps in higher-spin and cosmology for unification with Papers 8 and 10; no singularities due to infinite scales.

Full Paper

6.10 PBT Paper 10: Hybrid Push-Aether Theory (Weak/Strong Forces)

Models weak as leaks, strong as vorticity (updated from astrophysics).

- Key Equation:

$$\Gamma_{\text{weak}} \approx G_F^2 m^5 / (192\pi^3)$$

.

- Significance: Neutron lifetime $\sim 880 \text{ s}$; confinement $\sim 10^{-15} \text{ m}$.

Full Paper

6.11 PBT Paper 11: Hybrid Push-Aether Theory (Empirical Tests)

Synthesizes alignments for unification (updated from quantum gravity).

- Key Equation:

$$m_\nu \approx 10^{-3} \text{ eV}$$

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- Significance: Aligns with proton decay, neutrino data.

Full Paper

6.12 PBT Paper 12: Top Five Equations

Highlights successes over historical models.

- Key Equation:

$$g \approx 2$$

from vorticity; CHSH ~ 2.82 .

- Significance: Matches g-2 anomaly $< 10^{-12}$; entanglement without non-locality.

Full Paper

References

- Wikipedia Contributors. Alternatives to general relativity. *Wikipedia*, 2023a. URL https://en.wikipedia.org/wiki/Alternatives_to_general_relativity.
- Wikipedia Contributors. Le sage's theory of gravitation. *Wikipedia*, 2023b. URL https://en.wikipedia.org/wiki/Le_Sage%27s_theory_of_gravitation. Accessed August 2025.
- Matthew R. Edwards. The gravitation theory of georges-louis le sage. *APS Meeting Abstracts*, 2006. URL <https://ui.adsabs.harvard.edu/abs/2006APS..NWS.F1001E/abstract>.
- Benoit Famaey and Stacy S. McGaugh. Modified newtonian dynamics (mond): Observational phenomenology and relativistic extensions. *Living Reviews in Relativity*, 15(1):10, 2012. doi: 10.12942/lrr-2012-10. URL <https://link.springer.com/article/10.12942/lrr-2012-10>.
- Sabine Hossenfelder. Quantum mechanics is wrong. there, i've said it. *Backreaction Blog*, 2019. URL <http://backreaction.blogspot.com/2019/05/quantum-mechanics-is-wrong-there-ive.html>.
- Walter Thirring. Mechanical model for quantum field theory. *Journal of Mathematical Physics*, 4(3):332–338, 1963. doi: 10.1063/1.1703957. URL <https://pubs.aip.org/aip/jmp/article/4/3/332/230278/Mechanical-Model-for-Quantum-Field-Theory>.