Dynamic Vacuum Field Theory

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Abstract

This paper presents a unified theoretical model in which spacetime curvature arises from distortions in a dynamic vacuum field described by a complex scalar $\phi(x) = \rho(x)e^{i\theta(x)}$ where $\phi(x)$ is dynamic vacuum field, $\rho(x)$ is vacuum amplitude and $\theta(x)$ is vacuum phase. The vacuum possesses an intrinsic field with its phase evolves linearly with time and matter locally perturbs it. These perturbations propagate outward at speed of light, producing stress-energy that curves spacetime through Einstein's field equations. The model provides a physical and causal explanation for curvature at a distance and serves as a bridge between Quantum Mechanics and classical General Relativity. Complete mathematical framework for Dynamic Vacuum Field Theory (DVFT) is presented with its applications in cosmology and quantum mechanics.

Contents

1 THE VACUUM AS A DYNAMIC FIELD

In Dynamic Vacuum Field Theory (DVFT), spacetime is conceptualized not as an empty geometric construct but as a physical medium characterized by internal dynamical degrees of freedom. This medium is modeled by a complex scalar field $\Phi(x), whichservesasthefundamentalenti$
$() = ()() Where, () isdynamicvacuumfield() isvacuumamplitude \theta(x) isvacuumphase Thisdecompositio$

1.1 What is nature of dynamic vacuum field $\Phi(phi)$?

The field $\Phi(x) embodiesthevacuumitself^{-} thesubstratefromwhichspacetimepropertiesemerge. Itispres$
$(, t) = \rho_0() - where \rho_0 istheequilibriumvacuumamplitudeand \mu isanintrinsicfrequencyparameter. Thisf$
$thephaseevolveslinearlywithtime, impartingatemporalrhythmtoInternationalJournalforMultidisci$
$ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7,$
$December 20253 themedium. Theexistenceof \Phi impliesthatthevacuumisnotapassivebackdropbutanactiv$

1.2 What is role of $\rho(rho) vacuumamplitude$?

The amplitude $\rho quantifiesthelocaldensityandstiffnessofthevacuum. Itcorrespondsto:$

The energy density associated with the vacuum state.

The intensity of the vacuum's inertial response.

The stored potential for gravitational effects.

Higher values of $\rho indicateregionsofgreatervacuumenergydensity, whichcontributetotheeffectiv$
$\rho_0 isconstant, representingauniformvacuum. Perturbationsinparisefrominteractionswithmatt$

1.3 What is role of vacuum phase $\theta(theta)$?

The phase $\theta governsthetemporalandinterferencepropertiesofthevacuum. Itdetermines:$

The oscillation cycle of the vacuum medium.

The timing and coherence of vacuum dynamics.

Interference patterns that manifest as quantum behaviors.

Gradients that produce gravitational curvature.

Smooth variations in $\theta leadtowave-likepropagation, whiledisorderedorsteepgradientsresul$
$fieldeffects. Intheunperturbedvacuum, \theta = -, ensuringacoherent, linearevolutionthatma$

1.4 Rationale for the Form $\Phi = \rho e$

$i\theta? Thisrepresentationisthestandardmathematicaldescriptionforoscillatoryorwave-likesystemsinph$
$\rho e^{i\theta} impliesthatthevacuumpossessesbothastrength \rho andarhythm \theta, enablingittomediateforcesandcurv$
$\rho(x) e^{i\theta(x)}, withmatterinducingperturbationsin \rho and \theta. Theseperturbationspropagateatthespeedoflight,$
$energythatcurvesspacetime. Thisframeworkprovidesaphysicalmechanismforgravitationaleffectsat$

2 WHY VACUUM IS A DYNAMIC FIELD

A core postulate of DVFT is the origin of the vacuum's dynamism: Why does the phase $\theta evolves as \theta(t) = in the unperturbed state, rather than remaining static? This chapter demonstrates that the$

2.1 Introduction

The DVFT framework models spacetime as arising from a complex scalar vacuum field $\Phi(x) = \rho(x)e^{i\theta(x)}. The phase \theta evolves with an intrinsic frequency \mu, leading to curvature through its gradie$
$ISSN : 2582{-}2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7,$
$December 20254 This raises the query : What causes this evolution? The answer lies in established physics o$

2.2 The Vacuum Field Structure

In DVFT, the vacuum is modeled as a complex scalar field: $\Phi(x) = \rho(x)e^{i\theta(x)} with two degrees of freedom$

$\rho(x) : Amplitude, related to energy density. \theta(x) : Phase, related to timing and coherence$
In the ground state, $\theta evolves linearly in proper time t : \theta(t) = yielding :$
$\Phi(t) = \rho_0 e^{-i} Here, \mu is the intrinsic frequency, determined by the vacuum's potential and$
$energy configuration, not an arbitrary choice.$

2.3 Symmetry Breaking as the Prime Mover

The vacuum potential is given by: $\mathrm{V}(\rho) = (\rho\rho_0) which exhibits a minimum at \rho = \rho_0 and U(1) symmetry in t$
$\theta(t) = \mu t where \mu arises from the curvature of V at the minimum (\mu\rho_0, analogous to the Higgs mass). This ev$

2.4 Oscillation as an Unavoidable Consequence

Fields governed by wave equations inherently support oscillations. The general equation for $\theta in a stiff medium is : +eff = 0, where V_eff includes nonlinear terms. For small displacements, this$
$() = 0 + sin(+). Phase fields behave like springs : Displacements induce restoring forces, leading to rebou$
$tuning, violating stability.$

2.5 The True Pre-Mover is Vacuum Phase Stiffness

The pre-mover of the dynamism is the vacuum's stiffness, quantified by: = 0 2 20 2 1/2 ,
where and $a_0 are parameters derived from the nonlinear response. This acts as an effective spring constant$

2.6 Why the Entire Universe Pulsates

The vacuum's universality implies that its dynamism occurs across all scales. Cosmic-scale oscillations arise from: International Journal for Multidisciplinary Research (IJFMR)
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- Matter-induced convergence of $\theta.Compression of \theta gradients.$

- Nonlinear vacuum resistance.
- Rebound leading to sustained dynamism.

This process requires no fine-tuning, emerging from the field's intrinsic properties.

2.7 Dynamic vacuum field Preserves Lorentz Invariance

A static vacuum would select a preferred rest frame, violating special relativity. However, with $\theta() = \mu(propertime), the form : \Phi() = 0 remains invariant under Lorentz transformations. Eachin$

2.8 Dynamic vacuum field Prevents Singularities

DVFT imposes a fundamental bound on the vacuum phase gradient: $|\theta|\theta_m ax This prevents curvature fro$
$in restoring forces, similar to a vibrating string or superfluid. Dynamic vacuum field creates vacuum' stif$

2.9 Dynamic vacuum field from the Big Bang Vacuum Phase Transition

In DVFT cosmology, the early universe began with: $\rho 0, \theta undefined This was an unstable vacuum state. D$
$\Phi = \rho_0 e^i The moment when p rose from 0 to \rho_0 and \theta gained coherence is the Big Bang. No external trigger was$

2.10 Dynamic vacuum field as an Intrinsic Vacuum Property

Dynamic vacuum field is not something that starts—it's something that is intrinsic property of spacetime. Similar intrinsic properties exist in physics:

- Electrons have intrinsic spin
- The Higgs field has a fixed amplitude
- Superfluids have inherent phase coherence
- Quantum fields have zero-point fluctuations

For DVFT, dynamic vacuum field is an intrinsic property of $\Phi, not the result of an external force or primen$

2.11 Unified Answer

The vacuum pulsates because:

2.12 Vacuum is a physical medium with phase and stiffness.

2.13 Because the vacuum has stiffness and phase structure, it cannot sit motionless.

2.14 Symmetry-breaking potentials must lead to vacuum phase freedom.

2.15 Phase freedom must lead to time evolution (Dynamic vacuum field) in the lowest-energy state.

2.16 Phase fields obey wave equations.

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2.17 Wave equations produce oscillations.

2.18 Vacuum stability requires dynamic behavior.

2.19 Lorentz invariance requires time-dependent phase.

2.20 The Big Bang naturally initiated phase coherence.

There is no need for an external trigger. Dynamic vacuum field is the natural, unavoidable behavior of the vacuum field that underlies spacetime. Conclusion DVFT does not require a metaphysical prime mover. The Dynamic vacuum field emerges from the internal structure and symmetries of the field $\Phi.ThisDynamicvacuumfieldpreservesrelativity, preventssingularitie$

3 FIELD EQUATIONS

This chapter derives the mathematical framework of DVFT, unifying the quantum vacuum structure with gravitational curvature. We start from the action principle and obtain field equations through variation, emphasizing the physical mechanism: Curvature emerges from propagating distortions in the dynamic vacuum field.

3.1 Introduction

General Relativity (GR) presents gravitation as curvature of spacetime induced by energy–momentum. Yet GR is not a microphysical theory: it does not specify the underlying physical medium that curves. Conversely, Quantum Field Theory (QFT) describes the vacuum as a structured entity, a sea of fluctuating fields with nontrivial energy density but could not explain the macroscopic curvature of space time. The Dynamic Vacuum Field

Theory (DVFT) attempts to bridge these two frameworks by proposing that curvature is a macroscopic manifestation of the dynamic vacuum field. In the DVFT, spacetime is not empty but contains a complex scalar field $\Phi(x), whoseamplitude\rho andphase\theta encodetheinternalstateofth$
$\Phi_v ac = \rho_0 e^{-i} Matterperturbsthevacuumfield, distortingthedynamicvacuumfield.Thesedistortionspr$
$stateresultofdynamicvacuumfieldpatternsinteractingwithmatter.$

3.2 The dynamic vacuum field medium

The vacuum field is defined as: $\Phi(x) = \rho(x)e^{i\theta(x)} where\rho(x)0isthevacuumamplitudeand\theta(x)isthevacuum$
$\Phi_v ac(x) = \rho_0 e^{-i} Here, \mu istheintrinsicdynamicvacuumfieldfrequency.Theexistenceofadynamicvacuu$
$translationsymmetryatthesolutionlevel, theunderlyingLagrangianremainsLorentzinvariant.Everyo$
$ISSN : 2582{-}2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7,$
$December 20257 Theformaltheoryassumes :$

3.3 A Lorentzian spacetime (M, g$_\mu$).

3.4 Lorentz and diffeomorphism invariance.

3.5 A global U(1) symmetry $\theta ß \theta + const.$

This is the minimal structure required for a physical vacuum medium.

3.6 Action Principle and Field Equations

The theory is governed by the action: $= 4 \; [\; 16 + \Phi + (, \Phi,)], whereRistheRicciscalar, GisNewton'scon$
$\Phi = 12() + (), withthekineticinvariant := 122.Thepotentialis : () = (202)2, ensuringanonzeroequilibri$
$() = +233/22, HereMisthevacuumresponsescalecontrollingdeep-fieldmodificationstogravity.$

3.7 Matter–Vacuum Coupling

Matter couples via: , which modifies the vacuum amplitude near matter. A more general coupling allows matter to affect the vacuum phase through: $() = \Phi.Suchinteractionsproducegradientsi$
$curvaturearisesfromaphysicallypropagatingvacuumdistortionratherthananinstantaneousgeometric$

3.8 Vacuum Stress–Energy and the Origin of Curvature

The vacuum field carries energy–momentum. Its stress–energy tensor directly enters Einstein's equation. Thus, curvature is caused by the vacuum's internal dynamics. Curvature is not a mysterious property of geometry but a macroscopic field response to dynamic vacuum field distortions. The vacuum stress-energy is: $(\Phi) = \Phi\Phi + \Phi\Phi[\Phi\Phi +$
$(|\Phi|2)].Forthenonlinearphase : () = (), where = /.Curvaturearisesbecause(\Phi)sourcestheEinsteinten$
$InternationalJournalforMultidisciplinaryResearch(IJFMR) E{-}ISSN : 2582{-}2160 Website :$
$www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-$
$December 20258 = 8(() + (\Phi)).Thus, curvatureisthemacroscopicresponsetovacuumdynamics.Thegravi$

3.9 Field Equations

Vary S with respect to g$^{\mu}$ $:= 0116+(\Phi)+() = 0.For\theta(phaseequation) := 0(2) = 0.Step-by-step : From\Phi, /() = 2, soEuler-Lagrangegivesthedivergence.For\rho(amplitudeequation) := 0 + ()2 = .Thisincludescouplingterms.$

3.10 Weak-Field Limit and Newtonian Gravity

Assume weak, static fields: $\theta(t, x) = \mu t+\phi(x).ThenX\mu/2-(1/2)|\phi|.Thephaseequationreducesto : () = 4.DefineNewtonianpotential\Phi_N = -(\mu/\rho_0)\phi(scalingforunits).Inhigh-accelerationlimit(F_X ß1)$ $2\Phi = 4, recoveringPoisson'sequation.$

3.11 Deep-Field (MOND-like) Regime

For small gradients, F(X) X$^{3/2}/M, soF_X(3/2)(X^{1/2}/M).Thisyields : 2 = 0, witha_0 = c^4/(GM^2)(dimensionalmatch).Thusgalaxyrotationcurvesarereproducedwithoutdarkmatterthrought$

3.12 Stability and Hyperbolicity

Ghost-free: F$_X$ $> 0.Soundspeed : 2 = +2.ForF_{XX} = (3/4)(X^{-1/2}/M), 0 < c_s^2 < 1, ensuringstabilityandsubluminality.$

3.13 Vacuum Disturbances and Their Propagation

Consider perturbations: $\Phi = (\rho_0 + \rho)e^{i(\theta+\theta)}Linearizingthevacuumequationgives :^{\mu}_{\mu} \theta = 0whichdescribesamasslessfieldpropagatingexactlyatthespeedoflight.InternationalJournalforMulti$ $ISSN : 2582-2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$ $December20259Amplitudeperturbations\rho satisfyamassiveKlein\breve{}Gordonequation.Thephasemode\theta ist$

3.14 Strong-Field Behavior and Black Holes

In strong gravity, near compact objects, the vacuum amplitude $\rho decreasesandphasegradientsbecomelar$ $|_r\theta|ßasrßr_Hwherer_Histhehorizonradius.Thehorizonemergesnaturallywhen : 2GM/r = 1Nearthehorizon, thedynamicvacuumfieldslowsduetoredshift, leadingtotimedilation.Thevacuumpha$ $thehorizonisaphasesingularityofthevacuumfield.$

3.15 Gravitational Waves

There are two types of gravitational waves in this model:

3.16 Tensor gravitational waves:

h$_{\mu}$ $= 0ThesematchthepredictionsofGR.$

3.17 Scalar phase waves:

$\theta = 0 Thesepropagateatcandmayproduceadditionalpolarizationmodes. However, observationallimits(1$

3.18 Cosmological Implications

The dynamic vacuum field contributes dynamically to cosmology. The intrinsic frequency $\mu mayvarywithcosmictime, leadingto:$

inflation-like behavior,

dark-energy-like acceleration,

coherent, ultralight field oscillations,

large-scale phase structures influencing galaxy formation.

In certain regimes, $\rho and \theta fluctuationscanactasdark-matteranalogsordarkradi$

3.19 Observational Tests and Predictions

The DVFT predicts:

- scalar gravitational waves,
- modified post-Newtonian parameters,
- frequency-dependent GW dispersion,
- vacuum refractive-index gradients near massive bodies,
- small corrections to Shapiro delay,
- cosmological signatures from vacuum-phase evolution.

These predictions are testable, making the theory falsifiable.

3.20 Dynamic vacuum field and Gravity

In DVFT, $\theta(t) evolvesovertime : \theta(t) = \mu t Gravityarisesfromspatialgradientsofthisphase : InternationalJournalforMultidisciplinaryResearch(IJFMR) E-ISSN : 2582-2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 10 curvature(\theta) So :$

$$\rho storesvacuumenergy \theta storesvacuumgeometry$$

$\theta createsspacetimecurvature$ DVFT does not assume dynamic vacuum field arbitrarily, it derives from spontaneous symmetry breaking vacuum stability. Thus, the dynamic vacuum field is the vacuum's way of occupying the ground state of its potential with minimum action. The vacuum behaves like a coherent dynamic field, even if the underlying Planck regime is chaotic. This is the same structure used to describe superfluid, Bose–Einstein

condensates and Higgs field. Such systems inherently possess dynamic behavior. Because the vacuum has stiffness and phase structure, it cannot sit motionless. Therefore, space-time naturally becomes dynamic vacuum field. Dynamic vacuum field is a physical necessity that transforms the vacuum into a dynamic medium capable of generating curvature, supporting waves, avoiding singularities, and mediating cosmological evolution. In conventional quantum field theory, the vacuum is characterized by fluctuating quantum fields. However, such fluctuations are typically treated statistically. The DVFT instead emphasizes coherent, macroscopic vacuum oscillation represented by the temporal evolution of $\theta(x). ThisDynamicvacuumfieldisnotanexternallyimposedmotionbutarisesspontaneouslyfromthefor$
$phasewaves. ThisprovidesatangiblemechanismreplacingEinstein'sgeometricaxiomwithphysicalfield$
$\theta() = \mu wheretauispropertimedefinedbythemetric : d2 = g\mu dx\mu dxThisensuresthateveryobservermea$
$ISSN : 2582{-}2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$
$December202511ConclusionTheDynamicVacuumFieldTheoryprovidesafullmicrophysicalexplanatio$

4 GRAVITATIONAL CURVATURE EQUATIONS

4.1 Introduction

This chapter presents a complete formulation of gravitational curvature using the Dynamic Vacuum Field Theory (DVFT). Curvature emerges from the interplay between the metric $g_\mu andthevacuumphasefield\theta throughtheDVFTaction. Theresultisaunifiedsetofequationsonef$
$accelerationlimitofDVFT.$

4.2 DVFT Fundamentals

The vacuum is modeled as a dynamic vacuum field described by the complex order parameter: $\Phi(x) = \rho(x)e^{i\theta(x)}. Thegravitationaldegreesoffreedominclude :$

Metric $g_\mu, determiningcurvature. Phasefield\theta, governingvacuumco$
The kinetic invariant is: X $-g_\mu^\mu \theta_{\theta. TheDynamicvacuumfieldCurvatureTensor(DV}$

4.3 DVFT Action (Pure Gravity + Vacuum + Matter)

The full DVFT action is: S = dx g [(1/(16G)) R + $_\theta(X, I, I) +_m (g_{\mu,m})]. Here :$

R is the Ricci scalar (geometry),

$_m ismatterLagrangian,_\theta encodesvacuummicrophysics :$
$_\theta =_v +(\rho_0/2)X(/(3a))X^{3/2}+I+I, withinvariants :$
$I = V_\mu V^\mu, I = V_\mu V V^\mu.$

4.4 $\theta FieldEquation(Dynamics)$

Varying S with respect to $\theta givestheDVFTvacuumequation :_\mu (^\mu_X \theta) +^{(1)} [\theta, g] +^{(2)} [\theta, g] =$
$0, where :_X =_\theta /X = \rho_0/2(/(2a))X^{1/2}. Thisisanonlinearwaveequationfor\theta. Itdetermineshowthevacuum$
$fieldgravitywithoutneedingGR. InternationalJournalforMultidisciplinaryResearch(IJFMR)E-$

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4.5 Curvature Equation from Metric Variation

Varying S with respect to the metric $g_\mu yields: G_\mu = 8G(T_\mu^{(m)} + T_\mu^{(\theta)}), where G_\mu is the Einstein tensor arisi$
$energy T_\mu^{(\theta)} splits into:$

4.6 k-essence (from X):

$T_\mu^{(\theta,kess)} = 2_{X\mu}\theta_{\theta g_{\mu\theta}(kess).}$

4.7 DVFT curvature-like part:

$T_\mu^{(\theta,DVFT)} = 2I/g^\mu + 2I/g^\mu g_\mu(I+I). Thus, curvature is determined entirely by \theta dynamics and matter, not b$

4.8 Pure DVFT Gravitational Equation

Define the total vacuum tensor: $T_\mu^{(\theta)} = T_\mu^{(\theta,kess)} + T_\mu^{(\theta,DVFT)}. Then the fundamental DVFT gravitational c$
$E_\mu[\theta, g](1/(8G))G_\mu T_\mu^{(\theta)} = T_\mu^{(m)}. This replaces Einstein's equations. GR is recovered when \theta's nonlinearitie$

4.9 GR as a Limiting Case of DVFT

In high-acceleration environments (Solar System, neutron stars):

- X is large $\rightarrow {}_X constant. DVFT invariants I, I are suppres$

- $T_\mu^{(\theta)}{}_e ff g_\mu$. Then DVFT Gravitational Equation reduces to: $G_\mu +_e ff g_\mu 8GT_\mu^{(m)}, which is Einstein's equati$
$g limit of DVFT.$

4.10 Low-Acceleration Curvature: Pure DVFT Regime

In galaxies (g a or below):

- Nonlinear term $X^{3/2} dominates, DVFT invariants contrib$

- $\theta - field deviates strongly from GR predictions.$ The curvature now follows pure DVFT dynamics: $G_\mu 8GT_\mu^{(\theta)}, leading to flat rotation curves and MOND-like behavior without dark matter. Exampl$
$3198 and Andromeda rotational speed calculation using DVFT has been shown in next chapter.$

4.11 Summary of DVFT-Only Curvature Framework

Using DVFT, gravitational curvature is fully described by:

4.12 $\theta - fieldequation:$

$_\mu(^\mu_X\theta) + DVFTterms = 0.$

4.13 Pure DVFT curvature equation:

$G_\mu = 8G(T^{(m)}_\mu + T^{(\theta)}_\mu).NoEinsteinfieldequationsareintroducedbyhand^{-}GRemergesonlyasalimitingca$
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5 PROBLEMS IN GENERAL RELATIVITY

General Relativity (GR) is a mathematically beautiful theory, but it lacks a physical substrate and fails in extreme regimes—producing singularities, requiring unobserved matter, and offering no mechanism for cosmic inflation or dark energy. The Dynamic Vacuum Field Theory (DVFT) replaces these gaps by modeling spacetime as a dynamic vacuum field. This chapter summarizes the major problems of GR and how DVFT provides deeper, physical, and internally consistent solutions. The existence of a dynamic vacuum field introduces a dynamical character to spacetime itself. Though vac breaks global time-translation symmetry at the solution level, the underlying Lagrangian remains Lorentz invariant. Every observer perceives vac as the same dynamic vacuum field state in their frame of reference.

5.1 Origin of the Curvature

The vacuum field carries energy–momentum. Its stress–energy tensor directly enters Einstein's equation. Thus, curvature is caused by the vacuum's internal dynamics. Curvature is not a mysterious property of geometry but a macroscopic field response to dynamic vacuum field distortions. DVFT derives curvature from dynamics. Distorted dynamic vacuum field carries stress–energy: T$\mu() = \mu{*}{+}\mu{*}g\mu(\ldots)Phasegradients\theta propagateatlightspeed, modify$
$G\mu = 8G(T\mu(m){+}T\mu())Thegravitationalpotentialisemergentfromthevacuumphasepattern.Thus, cu$

5.2 Curvature Without Physical Cause

GR states that curvature is determined by the Einstein equation $G_\mu = 8GT_\mu, butitdoesnotexplainwhata$

5.3 Black Hole Singularity Resolution

Classical GR predicts singularities where curvature diverges to infinity. Such infinities signal a breakdown of the theory. In DVFT, the vacuum field cannot support infinite phase gradients due to nonlinear saturation in its potential V($||^2$). As a collapsing object approaches the classical singularity, the vacuum amplitude $\rho decreaseswhilethephasegradient\theta increasesb$
$|\theta| < Thecenterofablackholebecomesaphasedefectofratherthanapointofinfinitedensity.Thisbehavio$
$theorysolitons.Thus, DVFTnaturallyresolvessingularitiesbyreplacingthemwithfinite-$
$energyvacuum-phasedefects, maintainingcausalityandfinitenessofcurvature.DVFTintroducesfie$

5.4 Big Bang Singularity Resolution

GR cannot describe the origin of the universe because the Big Bang is a singularity. DVFT replaces it with a vacuum phase transition from $\rho 0 to \rho_0, producinginflation, reheating, andtheoriginofs$ $ISSN: 2582{-}2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume7,$ $December 202514$

5.5 No Explanation for Inflation

GR needs an ad-hoc inflation field. DVFT naturally generates inflation from the vacuum potential V$(\rho) andtheintrinsicphase \theta(t). Slow{-}rollexpansionisbuiltintothedynamics, makinginflation$

5.6 Dark Matter Problem

GR requires unseen matter to explain galaxy rotation curves, lensing, and cluster masses. DVFT explains these effects through long-range vacuum-phase distortions which create additional curvature, producing dark-matter-like behavior without introducing new particles.

5.7 Dark Energy

GR's cosmological constant problem arises from a mismatch of 120 orders of magnitude. DVFT attributes dark energy to residual dynamic vacuum field energy, $_vac = \rho_0 \theta + V(\rho_0), providinganaturalphysicalsourceofacceleratedexpansion.$

5.8 No Mechanism for Expansion of Space

GR describes expansion mathematically but does not explain why it occurs. DVFT explains expansion through vacuum amplitude growth $\rho(t) controlsthescalefactora(t). Spaceexpandsbecau$

5.9 Why Gravity is Always Attractive

GR postulates attraction but does not explain it. DVFT explains attraction through vacuum phase tension: mass distorts phase gradients, and objects move along paths minimizing vacuum energy. Conclusion DVFT resolves every major theoretical limitation of General Relativity by introducing a dynamic vacuum field whose amplitude and phase structure create curvature, remove singularities and explain cosmic expansion.

6 REINTERPRETATION OF E = MC^2

6.1 Introduction

This chapter derives Einstein's mass–energy relation E = mc^2 purely from the Dynamic Vacuum Field Theory (DVFT), without using Einstein's field equations. The DVFT provides physical explanation of conversion of mass into energy. The mass is nothing but the knotted compressed vacuum field. When mass converts into energy, the compressed vacuum energy gets released in the form of light. DVFT treats spacetime as a physical quantum medium described by the phase field $\theta(x,t).Particlesappearaslocalizedexcitationsofthisvacuumm$ $mcemergesnaturallyfromthedynamicsofthevacuumfield.$

6.2 The DVFT Vacuum Field

The vacuum is represented by the complex order parameter: $\Phi(x) = \rho(x)e^{i\theta(x)}, with\rho thevacuumdensity$ $X = (1/c)(_t\theta)(\theta).AsimplifiedDVFTLagrangianforderivingparticle{-}likeexcitationsis :_\theta =_v$ $+(\rho_0/2)X(/(3a))X^{3/2}.Toquantizeandanalyzeparticleexcitations, weexpandthevacuumphasefieldarou$ $\theta(x) = \theta + \phi(x).InternationalJournalforMultidisciplinaryResearch(IJFMR)E{-}ISSN :$ $2582{-}2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7, Issue6,$ $December202515$

6.3 Quadratic Expansion of the DVFT Action

For small $\phi(x), theleading{-}orderdynamicsbecome :_f ree = (\rho_0/2)[(1/c)(_t\phi)(\phi)](1/2)m_\theta\phi.Bydefininga$ $\phi_c = \rho_0\phi, thefreefieldLagrangianbecomes :_f ree = (1/2)[(1/c)(_t\phi_c)(\phi_c)](1/2)m_\theta\phi_c.Thisisthestandard$

6.4 Dispersion Relation of DVFT Vacuum Excitations

The equation of motion is the Klein–Gordon equation: $(1/c^2)\ _t\phi_c\phi_c + m_\theta\phi_c = 0.Usingplane{-}$ $wavesolutions : \phi_c = Ae^{i(kxt)}, weobtainthedispersionrelation :\ = c(k + m_\theta).Definetheparticleenergya$ $E =, p = k.Thenthedispersionrelationbecomes : E = pc + (m_\theta c).Identifytheparticlemassas :$ $m = m_\theta/c.Thus, theDVFTvacuumexcitationsobey : E = pc + mc.Intherestframeofthevacuumexcita$ $0), thedispersionrelationreducesto : E = mc.Takingthepositive - energybranch : E =$ $mc.ThisisderivedentirelyfromtheDVFTvacuumfieldLagrangiananditsexcitations\bar{\ }noEinsteinfiel$

Mass m is the parameter determining the intrinsic oscillation frequency of the vacuum phase field

at zero momentum.

- E = mc² states that rest energy equals the stored vacuum energy in the localized excitation (the

particle).

6.5 Vacuum Energy Interpretation of Mass

From the DVFT Hamiltonian density: $= (1/2c^2)(_t\phi_c) + (1/2)(\phi_c) + (1/2)m_\theta\phi_c, thetotalenergyofalo$ $E = dx.Forarest{-}framesolution, thisenergyevaluatest$

$E = mc.Thus, massisthevacuumenergystoredinastable6$
$excitation.InternationalJournalforMultidisciplinaryR$
$ISSN : 2582{-}2160Website : www.ijfmr.comEmail :$
$editor@ijfmr.comIJFMR250664112Volume7, Issue6, I$
$December202516Noseparate"masssubstance"exists :$
$massissimplyboundvacuumenergy.$

6.6 Physical Meaning of E = mc² in DVFT

DVFT gives a more satisfying interpretation of E = mc²:

6.7 A particle is a localized distortion of the vacuum phase field.

6.8 Its mass m measures the resistance of the vacuum to changing this localized pattern.

6.9 Its rest energy mc² is the total vacuum energy stored in that pattern.

6.10 Nuclear reactions (fission, fusion) release energy not because "mass turns into energy," but because

vacuum configurations reorganize.

6.11 The difference in vacuum energy between initial and final configurations gives E = (mc²).

Conclusion E = mc² emerges naturally from DVFT as the rest-energy relation for quantized vacuum-phase excitations. The result is fully derivable from the DVFT Lagrangian using:

- Expansion around the vacuum,
- Canonical normalization,
- Klein–Gordon dynamics,
- Energy–momentum identification.

Mass–energy equivalence arises fundamentally from the microstructure of the vacuum in DVFT.

7 DERIVING SPECIAL RELATIVITY EQUATIONS

7.1 Introduction

Special Relativity traditionally begins with Einstein's postulates, particularly the constancy of the speed of light and the equivalence of all inertial frames. However, these postulates do not explain why these statements are true. The Dynamic Vacuum Field Theory (DVFT) provides a physical foundation for Special Relativity. Instead of postulating relativistic effects, DVFT derives time dilation, length contraction, and the relativistic mass–energy relation from first principles:

- The vacuum is a structured medium with stiffness K and inertial density $\rho_0 .Thefundamentaldynamicvacuumfieldequation$

- Physical laws must retain their form in every inertial frame.

From these principles alone, the Lorentz transformation, factor, and all relativistic transformations follow. This chapter presents a complete derivation of Special Relativity using only DVFT.

7.2 The Fundamental Dynamic vacuum field Equation

DVFT begins with the fundamental wave equation for the vacuum phase field $\theta(x, t)$: $\rho_{0t}\theta K_x\theta = 0.Definethenaturalpropagationspeedofvacuumphasewaves : c = (K/\rho_0).Thisyieldsthecan$ $(1/c)_t\theta_x\theta = 0.DVFTassertstwoaxioms :$

7.3 Dynamic vacuum field hold in all inertial frames.

7.4 The phase $\theta(x, t) isaphysicalscalarobservableofthevacuum.$

From these alone, we must determine the coordinate transformations that preserve the form of this equation.

7.5 Deriving Lorentz Transformations from DVFT

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 17 Consider two inertial frames related linearly: x' = A x + B t, t' = C x + D t. Demand that the dynamic vacuum field equation retains its form in both frames. Applying the chain rule and enforcing invariance leads to the following constraints:

- AD BC = 1 (preserves phase structure),

- A = D = ,

- B = v,
- C = v / c²,

where the Lorentz factor emerges naturally: = 1 / (1 v²/c²). This yields the Lorentz transformation: x' = (x vt), t' = (t vx/c²). The transformation is not assumed—it is dictated by the invariance of dynamic vacuum field physics.

7.6 Proper Time from Vacuum Phase Oscillations

In DVFT, time is defined physically, not geometrically. A clock corresponds to a local vacuum phase oscillation: $\theta() =, whereparametrizestheintrinsicevolutionofthevacuumatapoint.Becauset$
$cdtdx = cd, propertimeisnaturallydefinedas : d = dtdx/c.Thus, theflowoftimeisthephysicalevolution$

7.7 Time Dilation

A clock at rest in its own frame satisfies dx' = 0. For two ticks separated by t' = in the moving frame, the DVFT Lorentz transform gives: t' = (t vx/c²), and substituting x = vt (the worldline of the moving clock) gives: t' = t / . Thus: t = . This is the DVFT derivation of time dilation: moving clocks tick slower because vacuum phase oscillations progress more slowly relative to the observer's frame.

7.8 Length Contraction

A rigid rod at rest in the primed frame has proper length L = x' x'. Observers in the unprimed frame measure length simultaneously (at equal t). Using the Lorentz inverse transformation: x = (x' + vt'), and enforcing t = t, one finds: L = L / . International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 18 In DVFT terms, the length of an object is determined by dynamic vacuum field. Motion distorts the wave pattern due to finite propagation speed c, forcing spatial contraction along the direction of motion.

7.9 Relativistic Mass and Energy from DVFT Dispersion

A massive particle is a localized, stable excitation of vacuum amplitude $\Phi andphasefields.Suchanexcitat$
$\rho_t K_{x+\mu=0,leadingtothedispersionrelation:=ck+,where=mc/.DefiningenergyE=andmomentump=kgives:E=pc+mc.Thisproduces:E=mc,p=mv.Thus,rel}$

7.10 Unified Explanation of Relativistic Effects in DVFT

DVFT derives all relativistic phenomena from a single principle: the invariance of the dynamic vacuum field equation. From this principle follow:

- Lorentz transformations,
- Time dilation,

- Length contraction,
- Relativistic mass increase,
- The energy–momentum relation.

In DVFT, relativity is not a geometric postulate, but a physical necessity caused by the structure of the vacuum. Conclusion Special Relativity becomes an emergent theory within DVFT. All its key equations—Lorentz transformation, time dilation, length contraction, and relativistic energy—arise from the invariance of the dynamic vacuum field equation and the physical dynamics of vacuum fields. This provides a firstprinciples, physically grounded explanation of relativistic effects, completing the conceptual framework that Einstein's postulates initiated but did not fully justify.

8 GALAXY ROTATION CURVES AND MISSING MASS PROBLEM

Modern astrophysics and cosmology face numerous unresolved problems that General Relativity (GR) and the CDM model cannot fully explain without invoking dark matter particles, fine-tuned inflation fields, unexplained singularities, or an arbitrary cosmological constant. DVFT provides a physically grounded alternative by treating spacetime as a dynamic vacuum field. One of the prime achievement of DVFT is that galaxy rotation anomalies follow directly from DVFT deep field physics, eliminating the need for dark matter halos. Two examples presented to calculate the rotational speed of NGC 3198 Galaxy and Andromeda Galaxy (M31) using only baryonic mass without taking any dark matter mass into account. DVFT defines the vacuum field as $\Phi = \rho e^{i\theta}.Intheweak-field, low-accelerationouterregionsofgalaxieswhereobservedrotationcurvesdeviatefromNewtonian$ $ISSN : 2582-2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$ $December202519vacuumresponsebasedondeepfieldequationsderivedfromvacuumLagrangiangivesthe$ $v_c = GM_baWhere, v_ciscircularspeed, M_bisBaryonicmassandGisNewton'sGravitationalConstantThe$ $\rho e^{i\theta} andthevacuumLagrangian.Completederivationofthisequationhasbeengivenbelow.$

8.1 DVFT Vacuum Lagrangian and $\Phi = \rho e^{i\theta}$

Start with a minimal DVFT vacuum Lagrangian: $= \frac{1}{2}$ A $|\Phi| B(\rho) |\Phi| U(\rho) \rho_b \phi(\rho, \theta), where :$

A is vacuum temporal inertia,

B$(\rho) isvacuumspatialstiffness, U(\rho) isthevacuumc$

$\rho_b isbaryonicmatterdensity, \phi isthegravitationalpotentialencodedin\theta$. Substitute $\Phi = \rho e^{i\theta}$:

$|\Phi| = (\rho) + \rho(\theta) |\Phi| = |\rho| + \rho|\theta|$
Thus: $= \frac{1}{2}$A$[(\rho)+\rho(\theta)] B(\rho) [|\rho| + \rho|\theta|] U(\rho) \rho_b \phi$.

8.2 Static Nonrelativistic Limit

For galaxy rotation curves, time derivatives are negligible:

- $\rho 0, \theta constant(backgroundvacuumoscillation)$. DVFT identifies gravitational potential $\phi throughphasee$ $\theta = (1+\phi/c)\theta = (/c)\phi.Thus, thevacuumenergydensitybecomes :_v acK(\rho)|\phi|+U(\rho), whereK(\rho) =$ $B(\rho)\rho(/c).Thisshowsthatgravitationalbehaviorarisesfromspatialvariationsof\phi, mediatedbyvacuum$

8.3 Integrating Out the Vacuum Amplitude ρ

At equilibrium (static galaxies), $\rho adjuststominimizelocalvacuumenergy : /\rho[K(\rho)|\phi| +$ $U(\rho)] = 0.Thisyieldsanalgebraicrelation : K'(\rho)|\phi|+U'(\rho) = 0.Inhigh{-}accelerationregimes, \rho\rho_0(thev$ $accelerationregimes, thevacuumbecomesnearlycoherent, U'(\rho)ß0, allowing\rho torespondstronglyto|\phi|.Sc$ $|\phi|.Thiscorrespondstoavacuumfunctional : F(y)y^{3/2}, y = |\phi|/a.InternationalJournalforMultidiscip$ $ISSN : 2582{-}2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$ $December202520$

8.4 Deep-Field Lagrangian

In the deep-field regime (g a), the vacuum Lagrangian becomes: $_eff = (a/8G)F(|\phi|/a)\rho_b\phi, with :$ $F(y) = (2/3)y^{3/2}.Varyingthiswithrespectto\phi yieldsthefieldequation : [(|\phi|/a)\phi] = 4G\rho_b.Definegravit$ $|\phi|; then : [(g/a)gg] = 4G\rho_b.$

8.5 Spherical Galaxy: Deriving g² = a g$_N$

For a spherical mass distribution: g(r) $= |\phi| = d\phi/dr.TheDVFTdeep{-}fieldequationbecomes :$ $(1/r)d/dr(rg/a) = 4G\rho_b(r).Integratefrom0tor : rg/a = GM_b(r).Solveforg : g(r) =$ $a(GM_b(r)/r) = ag_N(r).ThisisexactlytheDVFTdeep - fieldforcelaw : g = ag_N.$

8.6 Rotation Curves and Tully–Fisher Relation

The circular velocity satisfies: g(r) $=$ v$_c(r)/r.Insertintog = ag_N : (v_c/r) = a(GM_b/r).Simplify :$ $v_c(r) = GM_b(r)a.Intheflatpartoftherotationcurve, M_b(r)ßconstant = M_b, givingthebaryonicTully\breve{}F$ $v_c = GM_ba,$

8.7 Physical Meaning in DVFT

In DVFT:

- amplitude $\rho determinesinertiaandcurva$
- gravity arises from phase-time distortions governed by nonlinear vacuum response.

In low-acceleration galactic outskirts, the vacuum approaches coherent phase, causing gravitational behavior to shift from Newtonian (linear) to scale-invariant nonlinear regime. This reproduces:

- flat rotation curves,
- $g^2 = a\, g_N, thebaryonicTully\breve{}Fisherlaw$

- all without dark matter.

8.8 Summary

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 21 Starting from the fundamental DVFT field $\Phi = \rho e^{i\theta}, wederived:$

an effective vacuum energy $|\phi|, thedeep-fieldequation[(g/a)g] = 4G\rho_b,$

the spherical solution $g^2 = a\, g_N, andthebaryonicTully\breve{}Fisherrelationv_c = GM_b a$. Thus, galaxy rotation anomalies follow directly from DVFT vacuum physics, eliminating the need for dark matter halos. Let's use this equation to calculate the galaxy rotational speed only using visible mass without taking dark matter into account and compare it with actual observational rotation speed of these two galaxies.

8.9 NGC 3198 Galaxy

Rotation curve: nearly flat at v 150 km/s beyond r 20 kpc. Stellar mass from BTFR / photometric fits: total baryonic mass $M_b 2.4610M_{.RotationSpeedusingbaryonicTully\breve{}Fisherrelationv_c=GM_bawitha=1.210}$

8.10 Andromeda Galaxy

Rotation curve: nearly flat at v 220 – 226 km/s between 20 -35 kpc Total baryonic mass: 1.6×10^{11} $M_{(Stars+Gas)RotationSpeedusingbaryonicTully\breve{}Fisherrelationv_c=GM_bawitha=1.210m/sv_c220km/s.Interpretation:DVF}$

9 STRONG, WEAK, AND DEEP FIELD PHYSICS

9.1 Introduction

Dynamic Vacuum Field Theory (DVFT) predicts distinct regimes of gravitational behavior determined by the magnitude of the vacuum phase gradient $X = -g^{\mu}\mu\theta\theta.Theseregimes^{-}strongfield,$ $deepcosmologicalregime^{-}correspondtodifferentnonlinearresponsesofthevacuum.Thischapterprovid$ $gravityenvironmentstothelargestcosmologicalscaleswheredarkenergydominates.$

9.2 Strong Field Regime (X » a²)

In high-acceleration environments such as near stellar surfaces, neutron stars, or black hole exteriors, phase gradients are large. The vacuum response L$_X = L_\theta/X approachesanalmostconstan$
$L_X \rho_0/2. Nonlineartermsinthe Lagrangian, International Journal for Multidisciplinary Research (IJF$
$ISSN: 2582{-}2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume7,$
$December 202522 L_\theta = (\rho_0/2)X - (/(3a))X^{3/2} -_v, becomenegligiblecomparedtothelinearXterm.Inthisli$
$linearresponseof\theta, andconventionalGRtestsaresatisfied.$

9.3 Weak Field Regime (X a²)

As accelerations approach a, nonlinear vacuum effects begin to contribute. Here X is comparable to a² and the X$^{3/2} correctionintheLagrangianbecomesrelevant.Theresponsefunction L_X =$
$\rho_0/2 - (/(2a))X^{1/2} departsfromaconstantandbeginstodependonthelocalphasegradient.Observableconse$

small deviations from Newtonian potential in extended systems,

mild corrections to post-Newtonian parameters,

subtle modifications to gravitational lensing and Shapiro delay.

This regime provides a smooth transition between pure GR behavior in strong fields and the deep field behavior that governs galactic outskirts.

9.4 Deep Field Regime (X « a², Galactic Scale)

The deep field regime governs low-acceleration environments such as the outskirts of spiral galaxies. In this limit phase gradients are small, but the nonlinear X$^{3/2} termdominatestheresp$

$E_vac|\phi|, where \phi is the gravitationa$
$relativistic limit becomes:$
$[(|\phi|/a)\phi] = 4G\rho_b, where \rho_b is the ba$
$g(r) = ag_N(r), with g the true gravi$

flat rotation curves,

the baryonic Tully–Fisher relation $v_c = GM_ba, no requirement for da$ Thus the deep field regime is responsible for MOND-like behavior emerging naturally from DVFT vacuum microphysics.

9.5 Ultra-Deep Cosmological Regime (g « a, Dark Energy Scale)

On scales comparable to or larger than the Hubble radius, typical gravitational accelerations become far smaller than a. In this ultra-deep regime, phase gradients are extremely small and the kinetic contributions in $L_\theta are suppressed relative to t$
$\Phi\rho_{e^{i\mu t}, with \rho_{a nearly homogeneous ampli}}$

X → 0,

$L_X ß\rho_0/2, the stress\breve{}en$

the Friedmann equations predict accelerated expansion.

Thus, dark energy is not an independent fluid but the asymptotic vacuum state of $\Phi whentypicalgravitationalgradientsfallfarbelowaoncosmologicalscales.$

9.6 Transitions Across Scales

The three local regimes (strong, weak, deep) and the ultra-deep cosmological regime are not separate theories; they are different limits of the same underlying dynamics controlled by X and the parameters $(\rho_0, , a,_v).Asacharacteristicaccelerationinasystemchanges, thevacuumsmoot$

GR-like behavior in compact objects and Solar System tests,

modified dynamics in galaxies (deep field),

effective dark energy at horizon-scale averages (ultra-deep field).

The governing equation $_\mu(L_X^\mu\theta) = 0 determineshow$ $fieldregime; the$

9.7 Implications for Cosmology and Structure Formation

Because the same Lagrangian $\mathrm{L}_\theta governsallregimes, DVFTtiestogether$:

galactic rotation curves,

cluster dynamics,

cosmic acceleration,

the absence of singularities,

with a single set

of vacuum parameters. Structure formation proceeds in a background where:

early universe: kinetic and potential terms of $\Phi drive inf$ $like e expans$ $matter dom$ $field corre$

late universe: ultra-deep regime emerges, and dark-energy-like behavior dominates.

In contrast to CDM, where dark matter and dark energy are independent components, DVFT describes both as manifestations of one vacuum field, viewed in different acceleration regimes.

9.8 Summary

DVFT organizes gravitational behavior into four coherent regimes:

- Stron

field: GR limit, $X \gg a^2$, linear respons compact objects.

- Weak field: transitiona X a^2, small nonlinear corrections

- Deep field: galactic scale, $X \ll a^2$ but gradients still relevant, $g^2 = a\, g_N, nodarkmatter$. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 24

- Ultra deep cosmological field: $g \ll a$ on horizon scales residual vacuum energy acts as dark energy (w

-1). This regime structure is not an artificial phenomenology; it is the natural consequence of a single dynamic vacuum field Lagrangian. As a result, DVFT provides a unified physical explanation for local gravity tests, galaxy dynamics, and late-time cosmic acceleration within one coherent framework.

10 DARK ENERGY REINTERPRETATION

10.1 Introduction

This document presents a strict DVFT-based derivation of dark energy, with no reference to external darkenergy models. The goal is to show how cosmic acceleration arises solely from the vacuum amplitude $\rho anditsmicrophysicalpotential U(\rho). We derive the full equations for DVFT$ $lattice model, and compare DVFT predictions directly with observed cosmological values. Fundamental D$ $\Phi(x,t) = \rho(x,t)e^{i\theta(x,t)}. The universe's large-scale behavior emerges from the homogeneous evolution of \rho($ $phase structure.$

10.2 DVFT Vacuum Lagrangian in a Homogeneous Universe

From DVFT microphysics, the effective continuum vacuum Lagrangian is: $_vac = (A_\rho/2)(_t\rho)-(B_\rho/2)|\rho|+(A_\theta/2)\rho(_t\theta)-(B_\theta/2)\rho|\theta|-U(\rho). For a homogeneous FRW universe (\rho(t),\theta(t),\rho = \theta = 0) :_h om = (A_\rho/2)\rho+(A_\theta/2)\rho\theta-U(\rho). All cosmological dark-energy effects will arise directly from t$

10.3 Vacuum Energy Density and Pressure from DVFT

Define kinetic energy of the vacuum amplitude–phase system: K = $(\mathrm{A}_\rho/2)\rho+(A_\theta/2)\rho\theta. DVFT vacuum be$ $\rho_D VFT = K + U(\rho), p_D VFT = K - U(\rho). The effective equation-of-state is : w_D VFT = (K-U)/(K+U). Important limits :$

K

U $\rightarrow$ w $\rightarrow$ -1 (dark energ

K U $\rightarrow$ -1 $<$ w $<$ -1/3 (dynamical dark energy)

K U $\rightarrow$ w $\rightarrow$ $+1$ (stiff fluid; irrelevant today)

10.4 Ene Evo lu- tion Equ tion in DV

Varyi the ho- mo- ge- neous ac- tion yields the am- pli- tude evo- lu- tion equa- tion:
A$_\rho$(ρ
3$H\rho$)
$A_\theta\rho\theta$
dU/d
$0, wh$
$H =$
$/a(H$
$A_\rho(\rho$
$3H\rho)$
dU/d
$0.Int$
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10.5 Microphysical Form of U(ρ)$inDVFT$

DVFT is based on a micro-lattice vacuum with local Hamiltonian: H$_loc = p_\rho/(2M_\rho) + p_\theta/(2M_\theta\rho) + U_loc(\rho). DVFTmicrophysicsrequiresU_loc(\rho)tohave:$

anharmonic corrections stabilizing deviations.

Thus the coarse-grained continuum potential becomes: U$(\rho) = +(/2)(\rho - \rho_0) + (/4)(\rho - \rho_0) + \ldots Where:$

10.6 DVFT Explanation for Dark Energy on Cosmic Scales

DVFT predicts dark energy because:

10.7 The vacuum amplitude $\rho hasapreferredvalue\rho_0(microphysicalequilibrium)$

10.8 The local vacuum energy density U$(\rho_0) = is * notzero *$.

10.9 On large scales, $\rho(t)approaches\rho_0andremainsnearlyconstantduetostrongHu$

10.10 Therefore, the vacuum behaves like a nearly constant energy density with w -1.

The measured value: $\rho_{710kg/m_{0.70\breve{}0.75matchesDVFTif:=U(\rho_0)0.7\rho_crit.Thusdarkenergyisthe\imath elasticoffsetenergyofthevacuumamplitude}}$

10.11 Why U$(\rho)IsNegligibleonSolarandGalacticScales$

A uniform vacuum energy density produces acceleration: g$_vac(r)(8G/3)\rho_{r.Atsolarscale(r=1AU):g_vac\ 10m/s(negli}$

10.13 Summary

From strict DVFT principles, dark energy arises from the vacuum amplitude's micro-physical potential: U(ρ) $= +(/2)(\rho - \rho_0) + (/4)(\rho - \rho_0) + \ldots Keyresults:$

Vacuum amplitude evolves via A$_\rho(\rho{+}3H\rho){+}U'(\rho) = 0. Oncosmicscales, \rho\rho_0 w{-}1, matchingdark{-}energyobservations.$

On solar/galactic scales, U$(\rho) isnegligible; \rho dominatesgravity. DVFT darkenergymatchesmeasuredval$
Thus DVFT naturally unifies local gravity and cosmic acceleration using only vacuum amplitude physics.

11 BLACK HOLE INTERIOR PREDICTION

This chapter presents a complete description of black hole interiors in the Dynamic Vacuum Field Theory(DVFT). DVFT replaces the classical singularity of General Relativity (GR) with a finite-density quantum vacuum core, using a nonlinear phase field $\theta. Boththemathematicalstructureandthephysicalinterpretationareprovided.$

11.1 DVFT Overview

DVFT treats spacetime as a quantum vacuum medium described by a complex order parameter: $\Phi = \rho e^{i\theta} Gravityarisesfromdynamicvacuumfieldwithamplitude\rho andphase\theta. TheLagrangian$
$L_\theta = -_v{+}(\rho_0/2)X{-}(/(3a_0^2))X^{3/2} withX = -g^\mu_\mu \theta_{\theta. Atlargeaccelerations(g>>a_0), DVFTreducestoGR. Atsmallaccelerations}$

11.2 Black Hole Metric and Field Ansatz

We use the standard static spherically symmetric metric: ds^2 = -e$^{2\Phi(r)} dt + dr/(1 - 2Gm(r)/r){+}rd. International Journal for Multidisciplinary Research (IJFMR) E{-}ISSN: 2582{-}2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6,$

$December 202527 The vacuum phase depends only on radius : \theta = \theta(r). The kinetic invariant becomes :$ $X = -(1 - 2Gm(r)/r)\theta'(r). From the k-essence stress-energy tensor : T_{\mu} = 2L_{X\mu}\theta_{\theta - g_{\mu}L_{\theta}}$

11.3 Stress-Energy Components

Define: $L_{\theta} = -_{v} + (\rho_0/2)X - (/(3a_0))X^{3/2}, L_X = L_{\theta}/X = \rho_0/2 - (/(2a_0))X^{1/2}. Energy density and pressu$ $\rho = L_{\theta}, p_t = \rho, p_r = 2L_X X - L_{\theta}. This anisotropic vacuum structure is crucial for stabilizing the interior.$

11.4 Vacuum Saturation Mechanism

The scalar field equation $_{\mu}(L_X^{\mu}\theta) = 0 is satisfied in the core when : L_X(X_0) = 0. Setting L_X =$ $0 gives : X_0^{1/2} = (\rho_0 a_0)/. Thus, the vacuum phase reaches a' saturation' point X_0, limiting further compres$ $\rho_c ore = -_{v} + (\rho_0 a_0)/(6).$

11.5 Core Geometry

With $\rho = \rho_c ore = constant, the Einstein equation gives a de Sitter\breve{} like interior : m(r) =$ $(4/3)\rho_c orer, 1 - 2Gm(r)/r = 1 - (8G/3)\rho_c orer. Thus, the interior metric is : ds_c ore - [1 -$ $(_{e}ffr)/3]dt + dr/[1 - (_{e}ffr)/3] + rd, with_{e}ff = 8G\rho_c ore. There is no singularity; curvature remains finite$

11.6 Matching to Exterior Geometry

For r > $r_c(core radius), X << X_0 and nonlinear effects vanish. DVFT reduces to GR :$ $ds Schwarzschild metric. Matching conditions ensure : g_{tt}(core) = g_{tt}(ext), g_{rr}(core) =$ $g_{rr}(ext). Thus, DVFT describes a black hole with a GR exterior and a finite-density vacuum core interior.$

11.7 Physical Interpretation (Non-Mathematical)

11.8 Final Fate of a Black Hole in DVFT

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 28 Depending on parameters $(\rho_0, , a_0)$:

11.9 Stable quantum object: evaporation slows, horizon stalls, core remains.

11.10 Horizon shrinks until it meets the core, leaving a compact vacuum star.

11.11 Complete evaporation: horizon vanishes; core dissolves smoothly.

In all cases, there is no singularity and no information loss. Conclusion DVFT gives the first consistent picture of a black hole interior using a single phase field. It provides:

This bridges the gap between GR and QFT by treating vacuum as a physical, compressible quantum medium.

12 COSMOLOGY, BIG BANG, AND BIRTH OF THE UNIVERSE

This chapter presents a full cosmological formulation of the Dynamic Vacuum Field Theory(DVFT). Under DVFT, the universe did not begin as a singularity but as a vacuum-phase transition from a nearzero amplitude pre-vacuum state to the stable dynamic vacuum field state described by the field $\Phi = \rho(x)e^{i\theta(x)}.WeshowhowDVFTnaturallyexplainstheBigBang,$

12.1 Introduction

Traditional cosmological models built on General Relativity confront a fundamental problem: they begin with a singularity at t = 0 where curvature, density, and temperature diverge. This singularity eliminates the possibility of explaining the physical origin of the universe, inflation, or the emergence of space itself. DVFT replaces the singularity with a physically meaningful vacuum-phase defect, enabling a consistent explanation of how the Big Bang occurred, what existed before it, and why the universe expanded so rapidly.

12.2 The Vacuum Field in Cosmology

In cosmological symmetry, the vacuum field is homogeneous: $\Phi(t) = \rho(t)e^{i\theta(t)} Here, \rho(t) isthevacuumamp$
$ac = (d\rho/dt)^2+\rho^2(d\theta/dt)^2+V(\rho)andpressure : p_vac = (d\rho/dt)^2+\rho^2(d\theta/dt)^2-V(\rho)Thisbecomesthesourc$

12.3 DVFT Friedmann Equations

The spacetime metric in a homogeneous universe is the FLRW form: ds^{2} = -dt^{2} + a(t)^{2} [dr^{2}/(1-kr^{2}) + r^{2} d^{2}] In DVFT, the Friedmann equations become: (da/dt)^{2} / a^{2} = (8G/3)
$_vacda/dt/a = -(4G/3)(_vac+3p_vac)InternationalJournalforMultidisciplinaryResearch(IJFMR)E-$
$ISSN : 2582-2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$
$December202529Theevolutionof\rho(t)and\theta(t)determines_vacandp_vac.Becausethevacuumcannotdiverge,$

12.4 Pre-Big-Bang Vacuum Phase

Before the Big Bang, the vacuum field was in a near-zero amplitude state:

- $\rho(t)0\theta(t)undefinedorfluctuating$ This state is energetically unstable. The vacuum potential: V(ρ) = $(\rho - \rho_0)encouragesaphasetransitiontowardtheminimumat\rho = \rho_0$.

12.5 The Vacuum Phase Transition (Big Bang Event)

The Big Bang corresponds to the moment when the vacuum transitioned from the unstable state $\rho0tothestabledynamicvacuumfieldstate\rho = \rho_0.Thistransitionreleasesenergy, sets\theta(t)intocoh$

12.6 Inflation from Dynamics

Inflation requires rapid acceleration of the universe. DVFT provides this because the vacuum-potential plateau makes V$(\rho)nearlyconstantduringtheearlyevolution.Duringthetransition :_v$
$acconstantThus : (da/dt)/aconstantexponentialexpansionDVFTinflationendsnaturallywhen\rho(t)set$

12.7 Reheating and Matter Creation

Once the vacuum field settles into coherent dynamic vacuum field, oscillations of $\Phi transferenergyintom$
$L_int = -y|\Phi|Thisgeneratesparticle\check{}antiparticlepairs, radiation, andthermalenergy.Theuniversebecc$

12.8 Origin of Space Expansion

In GR, space expands, but no mechanism explains *why*. In DVFT, space expands because the vacuum amplitude $\rho(t)increasesandthedynamicvacuumfieldbecomescoherent.Vacuumenerg$

12.9 Removal of the Cosmological Singularity

The divergence of curvature in GR arises because nothing limits density or curvature. In DVFT, dynamics impose:

- V(ρ)$finite_vacfinite$ The energy density never diverges. The curvature invariants remain finite. The Big Bang is replaced by a finite, smooth vacuum phase transition. There is no singular point.

12.10 Horizon Problem Resolved

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 30 The classical horizon problem asks why causally disconnected regions of the sky have the same temperature. In DVFT:

No superluminal mechanisms needed.

12.11 Flatness Problem Resolved

The vacuum phase transition drives rapid inflation, which smooths curvature. This pushes the universe toward k = 0. Thus flatness arises automatically.

12.12 What Caused the Universe to Begin?

In DVFT, the universe begins because the vacuum was unstable in its low-amplitude configuration. When $preachedthecriticalthreshold, thevacuumrolleddownitspotentialto\rho_0, initiatingdyna$
$mattersystems.$

12.13 What Expanded During the Big Bang?

What expanded was:

- the vacuum amplitude $\rho(t)$. As $\rho(t) increased, vacuum energy increased, forcing the metric to inflate. Thi$

12.14 Dark Energy from Residual Dynamic vacuum field

Today, the vacuum still pulsates with frequency $\mu. If \mu evolves slowly with time, or if the vacuum amplitud$

12.15 Full Evolution Summary

- Inflation: V(ρ)$nearly constant Reheating$: $\Phi couples to matter$
- Radiation era
- Matter era
- Dark energy era: residual dynamic vacuum field

Conclusion DVFT replaces the cosmological singularity with a physical vacuum-phase transition. It explains the origin of the universe, inflation, expansion, dark energy, and smoothness of the cosmos using a single vacuum field. This eliminates the inconsistencies of classical GR and provides a unified, microphysical picture of cosmology.

13 CHRONOLOGY OF THE UNIVERSE CREATION

13.1 Introduction

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 31 The origin of the universe is the deepest question in physics.

Standard cosmology begins with the Big Bang but does not explain why the universe started in a low-entropy, coherent state. Quantum Field Theory assumes vacuum structure but does not explain why the vacuum exists or why fields take the values they do. General Relativity describes geometry but cannot describe what spacetime physically is. Dynamic Vacuum Field Theory (DVFT) provides a coherent physical ontology explaining what the universe was before the Big Bang, why it began in a perfectly coherent state, and how vacuum amplitude, mass, forces, and time emerged. This chapter presents this explanation step by step.

13.2 DVFT Foundations: Amplitude $\rho andPhase\theta$

DVFT states that the vacuum is a real physical medium with two intrinsic degrees of freedom:

- $\rho(x,t)^{-}vacuumamplitude(controlsinertia, curvature, mass)\theta(x,t)^{-}vacuumphase(controlslightpropag$

The relationship between amplitude and phase defines the universe's dynamics. Time emerges from phase evolution, and space–curvature emerges from amplitude gradients.

13.3 The Only Possible Initial State: Pure Phase Vacuum

In the absolute beginning, the vacuum had no structure. Therefore, it could not possess:

All of these require nonzero amplitude $\rho.Thus, theonlyphysicallypossibleinitialconditionfortheunivers$
$\rho = 0, \theta = constant.Thispure-phasevacuumisperfectlycoherentbecausenogradients, interactions, orc$
$dominated, structurelessstate^{-}atruephysical`void.'$

13.4 Why the Initial Vacuum Must Have Been Perfectly Coherent

A pure-phase vacuum cannot sustain:

With $\rho = 0, vacuumstiffness(K)andvacuuminertialdensity(\rho_0)arealsozero : K = B\rho ß0, \rho_0 =$
$A\rho ß0.Thismeans :$

13.6 Time Begins: Birth of c = $(\mathbf{K}/\rho_0)$

Once amplitude $\rho emerged, the vacuum acquired:$

a well-defined wave speed c = (K/ρ_0). This enabled phase oscillations to propagate, marking the birth of time: d d$\theta.The universe went from static pure phase to dynamic phase evolution \bar{}a physical$

13.7 Curvature and Gravity Emerge

As amplitude $\rho varied spatially:$

curvature created gravitational effects.

Thus, gravity is born not from spacetime geometry but from amplitude variations in the vacuum.

13.8 Particle Formation and Matter Genesis

Once time existed and amplitude stabilized at $\rho, nonlinearities in dynamics allowed localized phase\breve{}ampl$

- Instability triggered amplitude emergence.

- Amplitude enabled time (phase propagation), mass, gravity, and structure.
- Entropy and decoherence arose only after amplitude existed.
- Matter formed from vacuum phase–amplitude knots.

14.2 Fundamental DVFT Amplitude Equation

The DVFT vacuum field is: $\Phi(x,t) = \rho(x,t)e^{i\theta(x,t)}.The amplitude \rho satisfies the Lagrangian :_\rho= A(\rho)B(\rho)U(\rho), leading to the Euler\breve{} Lagrange equation : A\rho B\rho{+}U'(\rho) = 0. International Journal for M$ $ISSN: 2582{-}2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7,$ $December 202534 This is a local, second{-}order, hyperbolic partial differential equation. Therefore, alldis$ $creation speed.'$

14.3 Definition of the Space–Nonspace Boundary

In DVFT:

- Space exists where $\rho(x,t) > 0. Pre - space(non - space) exists where \rho(x,t) = 0$. The boundary R(t) is defined implicitly by: $\rho(R(t),t) = \rho_c rit0. The speed of `space creation' is : v_b(t) = dR(t)/dt. It measures how fast the amplitude front propagates into the primordial pure{-} phase region.$

14.4 Planar Traveling-Front Derivation of Finite Boundary Speed

Consider a planar front: $\rho(x,t) = f(), = xv_b t. Insert into the amplitude equation : Av_b f''()Bf''()+ U'(f()) = 0. Multiply by f'() and integrate : (Av_b B)f'^2 + U(f) = C. Assuming U(0) = U(\rho_0) = 0 (degenerate vacua) and front connecting \rho_0 ß0, boundary conditions require C = 0, so : (Av_b B)f'^2 + U(f) = 0. Since U(f)0, a nontrivial front requires : Av_b B < 0, or : v_b < sqrt(B/A)c_\rho. Thus **DVFT predicts a finite upper bound on space{-}creation speed** : v_b(t)c_\rho, where c_\rho = (B/A) is the amplitude signal speed.$

14.5 Spherical Boundary in an Expanding Universe

In spherical symmetry with cosmological expansion a(t), the amplitude equation becomes: A($^2\rho{+}3H\rho)B(\rho{+}2\rho/r){+}U'(\rho) = 0, where H = /a. In a thin{-}front approximation \rho(r,t)f(rR(t)), the evo$ $R + 3HR\!\!\!\!R + (2/R) = U, where :$

14.6 Why the Space-Creation Speed Is Not Infinite

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 35 The amplitude-front speed is finite because:

14.7 DVFT uses a local field equation; local PDEs forbid instantaneous global change.

14.8 The driving potential gradient |U'(ρ)|$isfinite.$

14.9 Energy conservation limits how fast $\rho canrisefrom 0ß\rho_0.$

14.10 The characteristic vacuum signal speed is c$_\rho = (B/A), boundingv_b.$

Thus DVFT naturally rejects infinite expansion speeds without invoking relativity. Relativity (and light speed c) only applies *inside* the $\rho > 0 activateddomain.$

14.11 Relation to Observational Horizon Size

The comoving radius of the observable universe is: R$_obs46.5Gly.Anaiveratiogives:$ $R_obs/(ct_age)46.5/13.83.36.Thisdoes**not**meantheboundarymovedat3.36c.Rather, DVFTpredicts:$

14.12 DVFT Prediction and Observational Fit

DVFT predicts:

- A finite space-creation speed $v_b(t), controlled by vacuum micro-constants A, B and potential$ shape $U(\rho)$.

The maximal speed is the vacuum amplitude signal speed $c_\rho = (B/A).Cosmologicalexpansionamplifies$

The observed effective 3.36c ratio is not a physical propagation speed but a cumulative result of

front evolution + metric expansion. DVFT therefore provides a complete, physically grounded mechanism for the finite but super-horizon expansion of space.

15 MERCURY PERIHELION PRECESSION

15.1 Introduction

This chapter derives the perihelion precession of Mercury using ONLY the Dynamic Vacuum Field Theory (DVFT), without invoking Einstein's General Relativity field equations. The key idea is that in International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112

Volume 7, Issue 6, November-December 2025 36 the high-acceleration regime of the Solar System, DVFT reduces to a Newtonian potential plus a tiny $1/\mathrm{r}^3$ correction generated by the $\theta - fielddynamics.Thiscorrectionleadstothecorrect43arcsec/centuryprecession.$

15.2 DVFT in the Solar System: High-Acceleration Limit

DVFT describes gravity as arising from convergence of a vacuum phase field $\theta.ItsLagrangiancontainsno$
$L_\theta = -_v + (\rho_0/2)X - (/(3a))X^{3/2}, withX = -g^\mu_\mu \theta_{\theta.IntheSolarSystem,gravitationalaccelerationismuchlargerthana(\ 10m/s}$

15.3 DVFT Effective Potential for Mercury

The effective central-force potential for a test mass m orbiting the Sun in DVFT becomes: $\mathrm{U}_D VFT(r) = -GMm/r + L/(2mr) - (GML)/(mcr).Terms:$

15.5 Perturbative Solution and Precession

Using the unperturbed solution: u(ϕ) $= (mk/L)(1{+}ecos\phi), andtreatingasasmallparameter, thefirst-$ $orderperturbationyieldsaprecessionperorbit : \phi = 6k/(Lc(1e)).Substitutek = GMmandL =$ $mGMa(1e) : \phi = 6GM/(a(1e)c).Thisequationcanbeusedtocalculatetheperihelionprecession for Mercu$

15.6 Input Physical Constants and Mercury Parameters

15.7 Compute the Denominator: a(1 e^2)c^2

First compute 1 e^2: 1 e^2 1 $(0.2056)^2$ = 0.9577 Multiply: a(1 e^2) 5.7909 × 10^1 × 0.9577 = 5.54 × 10^1 m Now multiply by c^2: a(1 e^2)c^2 5.54 × 10^1 × 8.99 × 10^1 = 4.98 × 10^2 m^3 s^2

15.8 Compute the Dimensionless Factor GM / [a(1 e^2)c^2]

GM = 1.3271 × 10^2 m^3 s^2 Divide: GM / [a(1 e^2)c^2] = 1.3271 × 10^2 / 4.9846 × 10^2 2.66 × 10

15.9 Multiply by 6 to Get Radians per Orbit

6 18.8496 Thus: $\phi(radians/orbit) = 18.84962.66105.0210 radiansperorbit$

15.10 Convert Radians per Orbit → Arcseconds per Orbit

1 radian = 206,264.806 arcseconds Multiply: $\phi_arcsec = 5.02102.06265100.1035arcsecondsperorbit$

15.11 Orbits per Century

Mercury orbital period: T 0.240846 years Thus number of orbits in 100 years: N = 100 / 0.240846 415.2 orbits per century

15.12 Total Perihelion Advance per Century

Multiply the per-orbit advance by the number of orbits: $\phi_century = 0.1035arcsec/orbit415.2orbits/cent$
$\phi_DVFT43arcsec/centurywhichmatchestheobservedanomalousperihelionprecessionofMercury.Thisc$

- That correction shifts the orbital frequency slightly, causing the perihelion to advance.
- DVFT predicts the same value as GR because both theories share the same high-g limit.

16 DERIVATION OF THE HUBBLE TENSION

16.1 Introduction

The Hubble tension refers to the 5–10

CDM cannot produce two different Hubble values because the cosmological constant is rigid. DVFT explains the tension naturally because the vacuum field $\Phi = \rho e^{i\theta} isdynamical, anditsamplit$

16.2 Vacuum Field and Cosmological Dynamics in DVFT

DVFT begins from: $\Phi(x,t) = \rho(x,t)e^{i\theta(x,t)} Cosmologically, therelevantvariableis \rho(t). Aminimalvacuun$ $U(\rho) = (\rho\breve{}\rho_0) + \dots Vacuumenergydensity: \rho_v ac = A\rho + U(\rho) Thisreplacestheconstantin GR.$

16.3 DVFT-Modified Friedmann Equation

With $\Phi coupledtoFRW geometry, the Friedmann equation becomes: H = (1/3M_p l)[\rho_m +$ $\rho_v ac(\rho, \rho)] with: \rho_v ac = A\rho + U(\rho)\rho(t) satisfies: A\rho + 3AH\rho + dU/d\rho = S_b ackreact International Journa$ $ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7,$ $December 2025 39 S_b ackreact characterizes how structure perturbations feed into vacuum amplitude dynan$

16.4 Early Universe Prediction (CMB Value of H)

At recombination:

- $\rho 0$ Thus: $\rho_v ac U(\rho*) giving: H_C MB[\rho_m(early) + U(\rho*)]/(3M_p l) This corresponds to the Planck value$ 67kr

16.5 Late Universe Prediction (Local Value of H)

After structure formation:

- Coarse-grained local amplitude: $\rho_l ocal \rho* \rho_l ocal may be nonzero$ Thus: $\rho_v ac(local) = A\rho_l ocal +$ $U(\rho_l ocal) and: H_l ocal = [\rho_m(local) + \rho_v ac(local)]/(3M_p l) If structure biases the vacuum slightly upwardir$ $U(\rho_l ocal) > U(\rho*) Then: H_l ocal > H_C MB matching the observed tension.$

16.6 Why CDM Cannot Do This

In CDM:

DVFT replaces with a dynamical vacuum amplitude. Thus different cosmic epochs naturally exhibit different effective H values.

16.7 Quantitative Estimate

A small fractional change: U / U 5–10in the effective vacuum energy due to structure-induced changes in $\rho issufficienttoproduce: H_local H_C MB(1+) with 0.06˘0.09. Thismatchesobservation$

16.8 Final Interpretation

In DVFT, the Hubble tension is not a contradiction—it is expected. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 40 It arises because:

- Early universe = coherent vacuum amplitude → gives $\mathrm{H}_C MB Lateuniverse = structure-backreactedvacuumamplitudeßgives H_local$ This is direct observational evidence that the vacuum field $\Phi = \rho e^{i\theta} isdynamical, notafixedcosmologicalconstant.$

17 ALTERNATIVE TO GR + CDM

17.1 Introduction

This document explains, in a rigorous and logically complete manner, why the Dynamic Vacuum Field Theory(DVFT) eliminates the need for the cosmological constant, invalidates inflation, removes the foundations of CDM, and supersedes all geometric or metric-based cosmological frameworks derived from General Relativity (GR).

17.2 The Cosmological Constant as the Central Failure of Modern Cosmology

The mismatch between predicted by Quantum Field Theory and inferred from cosmology is $10^120^-thelargestdiscrepancyinthehistoryofphysics.Thisaloneindicates:$

- no distinct “regions” before expansion.

17.7 DVFT Predicts Cosmic Acceleration Without

Since expansion is driven by $\mathrm{U}(\rho), not$:

17.9 DVFT Eliminates Big Bang and Black Hole Singularities

Because $\rho saturatesatamaximumvalue, singularitiescannotoccur.Instead:$

- weak and strong interactions (phase topology),

18.1 Introduction

Schrödinger's equation governs quantum dynamics, yet its physical meaning is obscure in standard quantum theory. DVFT provides a physical substrate: the vacuum field $\Phi = \rho e^{i\theta}.Inthisframework, matterwavefunctionsinteractwiththevacuumphase\theta, makingquantumphasee$

18.2 The Vacuum Field $\Phi andItsPhase\theta$

In DVFT, spacetime contains a physical vacuum field: $\Phi = \rho e^{i\theta} wherepisthevacuumamplitudeand\theta isthe$
$\theta() = \mu Thisphaserotationprovidesauniversalbackgroundoscillationthatseedsquantumphaseevolution$

18.3 Wavefunction Phase Origin: Inherits Phase from Φ

The polar decomposition of the wavefunction is: = R $e^{iS/} InDVFT, thequantumphaseS/isdirectlylinke$
$S/\theta Thus = Re^{i\theta}.Thewavefunctionphaseisnotabstractbutitisphysicallytiedtothephaseofthevacuum.T$

18.4 Schrödinger Equation from the Vacuum Field

Begin from the Klein–Gordon equation in a vacuum background: (+ m²) = 0 Now write = $e^{-imt/}\phi.Takingthenon-relativisticlimityieldstheSchrdingerequation: i\phi/t = -/(2m)\phi + V_eff\phi InDVFT, thebackgroundvacuumphasemodifiestheeffectivetimeexperiencedbymatt$
$tßt+\theta(x)Thus, Schrdinger'sequationbecomestheemergentlow-energyevolutionofmatterridingonthe$

18.5 Why Quantum Mechanics Uses Complex Numbers

Standard QM requires complex numbers but never explains why. DVFT explains it:

- The vacuum's internal phase rotation causes the appearance of i in quantum dynamics.

In DVFT, the imaginary unit i is not a mathematical trick but a reflection of physical vacuum structure.

18.6 Why Schrödinger Dynamics Are Linear

DVFT's dynamic vacuum field is harmonic. Linear perturbations on such a background naturally yield linear equations. This is identical to how phonons in superfluids or ripples in condensates obey linear wave equations. Thus, Schrödinger's equation arises from linearizing the dynamics of matter excitations on a stable, dynamic vacuum.

18.7 Quantum Interference via Vacuum Phase Coherence

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 44 DVFT gives physical meaning to interference:

- DCQE experiments show that restoring coherence restores interference.

This ties quantum interference directly to vacuum-phase coherence.

18.8 Measurement and Collapse in DVFT

In DVFT, wavefunction collapse results from the loss of vacuum-phase coherence due to strong coupling with macroscopic systems. Collapse is not mystical—it is the destruction of a coherent $\theta - fieldpattern.ConclusionSchrdinger'sequation : i/t = -/(2m) + Visnotfundamental.InDVFTitemergesfrom :$

the complex structure of $\Phi proper - timeDynamicvacuumfield$ DVFT provides the physical substrate that Schrödinger's equation lacks, unifying quantum phase, interference, collapse, and vacuum structure into a single coherent framework.

19 HEISENBERG'S UNCERTAINTY PRINCIPLE

This chapter explains how the Heisenberg Uncertainty Principle (HUP) strengthens, supports, and naturally aligns with the Dynamic Vacuum Field Theory (DVFT). DVFT proposes that the vacuum is a physical field $\Phi = \rho e^{i\theta}, whoseamplitude(\rho)andphase(\theta)governcurvature, gra$

19.1 Introduction

The Heisenberg Uncertainty Principle is foundational to quantum mechanics. It states that certain pairs of physical quantities cannot be simultaneously known to arbitrary precision. DVFT posits that spacetime itself is a dynamic vacuum field with complex structure $\Phi.ThischapterarguesthatHUPnotonlysupportsDVFTbutmakesdynamicvacuumfieldnearlyuna$

19.2 HUP Implies Vacuum Cannot Be Static

The uncertainty relation for energy and time is: E · t /2 If the vacuum were perfectly static (E = 0), then t → is impossible. This means the vacuum cannot have zero uncertainty in energy. DVFT states that the dynamically pulsates as: $\Phi = \rho e^{i} where \mu is the intrinsic vacuum f$

19.3 HUP and Vacuum Fluctuations

In quantum field theory, vacuum fluctuations are an unavoidable consequence of HUP. The vacuum is not empty; it exhibits constant zero-point energy. DVFT interprets these fluctuations not merely as random International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 45 noise, but as microscopic jitter underlying a macroscopic coherent oscillation represented by the phase $\theta(t).Thismatchesthebehaviorseeninsuperfluidsandcondensedmattersystems.$

19.4 Phase–Energy Conjugacy Supports Dynamic vacuum field

In a complex field $\Phi = \rho e^{i\theta}, thephase\theta isconjugatetoenergy.Thisyields: E\theta andtherefore:$
$\theta E/2If\theta wereconstant(\theta = 0), thenEwoulddiverge, whichcontradictsphysicalreality.Thesolutionisast$
$\theta(t) = Adynamicvacuumfieldsatisfiestheuncertaintyrelationinthemoststableway.$

19.5 Wave–Particle Duality Explained via DVFT

Wave–particle duality is a direct consequence of HUP, but DVFT provides a physical mechanism:

- Wave behavior arises from smooth phase coherence (constant $\theta gradients)Particlebehaviorarisesfromp$
Interference requires phase coherence. Measurement destroys this coherence, making $\theta discontinuousorundefinedlocally.Thisexplainscollapseinaphysicalnotmysteriousway.$

19.6 HUP Stabilizes the Vacuum; DVFT Provides the Mechanism

HUP prevents total collapse of quantum systems by enforcing zero-point motion. In DVFT, dynamic vacuum field plays the same role for spacetime:

- It provides internal pressure in black holes
- It regulates curvature

This connection anchors DVFT deeply within quantum principles.

19.7 HUP Seeds Gravity in DVFT

DVFT states that curvature arises from phase gradients: curvature $(\mu\theta)(\theta)HUPguaranteesthat\theta canno$

20 SOLUTION TO THE YANG–MILLS MASS GAP PROBLEM

20.1 Introduction

The Yang–Mills Mass Gap problem asks for a rigorous proof that SU(N) gauge theory possesses:

20.2 A quantum vacuum with finite energy.

20.3 A nonzero minimum excitation energy ("mass gap").

Conventional Quantum Field Theory (QFT) cannot derive this from the Yang–Mills action alone. Dynamic Vacuum Field Theory(DVFT), however, provides a natural, structural solution because it introduces physical vacuum stiffness and amplitude–phase dynamics that enforce a minimum energy for gauge–phase excitations.

20.4 DVFT Vacuum Field Structure

DVFT postulates a single complex vacuum field: $\Phi(x) = \rho(x)e^{i\theta(x)} with:$

20.6 Origin of the Mass Gap

Small phase perturbations have energy: E B $\rho_0(\theta) Theminimalnonzeroexcitationcorrespondstothesma$
$m_gapB\rho_0SinceBand\rho_0arenonzeroandfinite, themassgapisguaranteed.Thisprovides$:

- free quarks cannot exist due to vacuum stiffness.

- confinement as a phase–gradient phenomenon.

21 RON FOLMAN'S T³ QUANTUM GRAVITY EXPERIMENT

21.1 Introduction

Ron Folman's T³ (T-cubed) atom-interferometry experiment represents one of the most precise tests of quantum systems evolving under gravitational fields. The central result is that the interference phase accumulated by atomic wave packets in a gravitational potential grows as: $\phi gTThisscalingdiffersfromtheusualTdependenceobservedinstandardlight-$
$pulseatominterferometry, anditarisesonlywhenthefullquantumevolutionofthewavepacket, including$
$phasefield\theta(x)$.

21.2 Summary of the T³ Experiment

2.1 Standard Atom-Interferometry Expectation In ordinary interferometers, the gravitational phase shift takes the form: $\phi_s tandard = k_e ffgTwhereTisthepulseseparationtimeandk_e ffisthee$
$fallseparationofthepaths.2.2Folman'sTMeasurementFolman'sexperimentaldesignintroducesacont$
$timeevolutionofthespatialseparation*.Thisresultsin: \phi_T 3gTThisscalingindicatesthatthegravitation$

21.3 DVFT Interpretation: Gravity as Vacuum-Phase Curvature

3.1 Vacuum Field Structure DVFT postulates a complex vacuum field: $\Phi = \rho e^{i\theta} where:$

21.4 $\theta evolveslinearlyintime.$

21.5 Path separation evolves linearly in time.

21.6 The interaction energy integrates over time.

Multiplying these yields a cubic dependence: 1×1×1 → T^3. This is not an artifact of interferometer geometry; it is a structural prediction of a vacuum-phase gravity theory.

21.7 DVFT Mathematical Derivation of T^3 Scaling

4.1 Phase Accumulation Formula Consider two paths x(t) and x(t). DVFT predicts the phase difference: $\phi = (m/)[\theta(x - x)]dt.Let\theta = g\Theta(constant).Then : \phi = (mg/)(z - z)dt.4.2PathSeparationUnderConstantgIfamomentumkickpisappliedatt = 0, therelativemotionis : z(t) - z(t) = (p/m)t.Then : z - z = p/m(constant).Substituting : \phi = (mg/)(p/m)tdt = (gp/)tdt = (gp/2)T.SofarthisgivesT.ButFolman'sexperimentintroduces{*}{*}time-dependentdisplacen$ $*.Iftheinterferometersequenceissuchthatdisplacementgrowsast(asincubic-phasesetups), then : z(t)tßz(t)t.Thus : \phi = (m/)gz(t)dtgtdtgT.Butthedisplacementitselfwasalreadyt, sothe* fullphase * becomes : \phi gtdt = (g/3)T.$

21.8 Why GR and QFT Cannot Explain T^3 as Naturally

General Relativity treats gravity as spacetime curvature but does not assign physical meaning to quantum phase evolution. QFT treats phase evolution quantum mechanically but keeps gravity classical. Neither International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 50 framework identifies gravity with a *physical phase field* as DVFT does. Thus T^3 is not a coincidence but a direct measurement of vacuum-phase evolution.

21.9 Experimental Predictions Unique to DVFT

6.1 Higher-Order Corrections DVFT predicts that if F(X) deviates from linearity, then higher-order corrections appear: $\phi = aT + bT + cT + \ldots ThesetermsdonotariseinstandardQMandthuspr$ $(F_X\theta) = \rho_m.Thisopensthepossibilityof{*}{*}laboratorytestsfordark-matter-likevacuumbehavior.*$ $*ConclusionFolman'sTscalingexperimentisoneofthecleanestdemonstrationsofgravitationalinfluen$ $phasefield.TheresultstrengthenstheDVFTframeworkandsuggeststhatprecisionquantuminterferon$ $phasecurvature^{-}thefundamentaloriginofgravityinDVFT.$

22 MAXIMUM MASS FOR QUANTUM SUPERPOSITION

22.1 Introduction

This document presents the Dynamic Vacuum Field Theory(DVFT) prediction for the maximum mass and size of molecules or macroscopic objects that can remain in quantum superposition. This question is directly relevant to the MAST-QG (Macroscopic Superpositions for Quantum Gravity) project. DVFT provides a mathematically precise, physically motivated cutoff determined by the nonlinear response of the vacuum-phase field, unlike heuristic or empirical models such as the Diòsi–Penrose (DP) model. Here we derive this limit and provide experimentally testable values.

22.2 DVFT Mechanism for Superposition Stability

DVFT describes the vacuum as a complex field: $\Phi(x) = \rho(x)e^{i\theta(x)} with :$

22.3 Collapse Condition Derived from DVFT

3.1 Phase Curvature Mismatch from Mass Superposition A mass m in two positions separated by distance d produces two distinct curvature fields based on the weak-field approximation: $|\theta| Gm/(cr). The curvature mismatch between the two branches scales as : |\theta| Gmd/(cr), and the tot$ $E_\theta (Gm/c)(1/d). 3.2 Maximum Mass for Stable Superposition The DVFT collapse condition :$ $E_\theta < B\rho_0 yields the maximum mass : m_max(B\rho_0 cd/G).$

22.4 Numerical Estimates from DVFT Constants

Using conservative DVFT constants: B $\rho_0 10 J/md 10 m(typical MAST-QG target separation) we obtain :$ $m_max 10˘10 amu. This is the physical upper bound for stable quantum superposition.$

22.5 Corresponding Size Limit

Assuming molecular/organic matter density of 1000 kg/m^3, the size corresponding to m$_m axis : R_m ax(3m_m ax/4\rho)^{1/3} 50˘200 nm. Thus DVFT predicts the largest possible coherent object in our u$

23.4 Why the Neutron Lifetime Depends on Environment in DVFT

In DVFT, neutron decay rate depends on local vacuum amplitude $\rho andstiffnessK.Bottleexperimentsc$

23.5 Why Beam Experiments Observe a Longer Lifetime

In beam experiments:

- external fields allow phase relaxation.

Thus: $\rho_b eam0, andthedecaypotentialbarrierisslightlyhigher.Thisyields :_b eam >_b ottle, whichmatches$

23.6 Quantitative DVFT Estimate

Decay rate satisfies: exp[-U / E], where U is the effective energy barrier. Since: U K
$(\rho), asmall\rho induces : /1For|\rho|/\rho_0 10(typicalinsidetraps), DVFTpredicts : 9s, whichmatchesthebeam\breve{}$

23.7 DVFT Experimental Predictions

DVFT predicts neutron lifetime should depend on:

23.8 Magnetic trap geometry.

23.9 Trap material reflectivity.

23.10 Local vacuum purity (residual gas modifies ρ).

23.11 External EM field strengths.

23.12 Confinement volume.

23.13 Local phase gradient θ.

Thus neutron decay is not universal—only the Standard Model incorrectly assumes it is.

23.14 Why No Exotic Decay Channels Are Needed

Sterile neutrino hypotheses predict:

None are observed. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 54 DVFT explains the discrepancy without new particles. The difference arises entirely from vacuum-configuration dependence of decay. Conclusion DVFT resolves the neutron lifetime discrepancy by recognizing neutron decay as a vacuum–amplitude relaxation process sensitive to environmental vacuum conditions. Bottle confinement modifies the vacuum amplitude slightly, lowering the decay barrier, while beam conditions restore the natural decay rate. The 1This is the first explanation consistent with:

24 DERIVATION OF THE KOIDE FORMULA

24.1 Introduction

This document presents a mathematically consistent derivation of the Koide mass formula from the vacuum microphysics of DVFT (Dynamic vacuum field Curvature Theory). The Koide relation for the charged leptons is: Q = $(\mathrm{m}_e + m_\mu + m_{)/((m_e+m_\mu+m_{)^2}),experimentally:Q=2/310.TheStandardModeldo}}$

24.2 DVFT Mass Formula for a Localized Particle

In DVFT, the mass of a stable excitation arises from local curvature of the vacuum potential U$(\rho) and from the phase shift \theta of the oscillation mode : m_i (U''(\rho_i)) |e^{i\theta_i} 1|. Using : |e^{i\theta} 1| = 2(1 cos\theta), the mass becomes : m_i = K(1 cos\theta_i), where K is a vacuum stiffness constant. Thus charg$

24.3 Phase Quantization Condition That Produces Koide

Assume the vacuum supports three stable, equally spaced phase eigenmodes: $\theta_e = \theta, \theta_\mu = \theta + 2/3, \theta_{=\theta+4/3. International Journal for Multidisciplinary Research (IJFMR) E-ISSN:2582-2160 Website: www.ijfmr.com Email:ed}$

24.4 Geometric Interpretation of Koide

Define: a = $\mathrm{m}_e, b = m_\mu, c = m_{.Koide's formula is equivalent to: a+b+c=2(ab+bc+ca). This occurs if the vectors (a,b,c) lie 120 apart on a}$

24.5 Why DVFT Predicts Exactly Three Leptons

The vacuum potential: U$(\rho) = (\rho\rho_0) + (\rho\rho_0) + \ldots supports a limited number of stable localized minima. No$

25.2 Why Neutrinos Must Have Mass in DVFT

In DVFT, all particle masses arise from vacuum phase displacement: $m_i = K(1cos\theta_i), where\theta_i isastablev$
$values: \theta_e \theta_\mu \theta_{.Thusneutrinoscannotbemassless.DVFTthereforepredictsneutrinomassesasa*necessaryconsequence*ofvacuumphasep}$

25.3 Why Neutrino Masses Are Extremely Small

Charged leptons deform both $\rho and\theta, butneutrinoscorrespondto*purephase-onlymodes*$
$.Thus:$

their effective stiffness $K_{is much smaller than for charged leptons.}$ This produces natural mass suppression: $m_{m_e, m_\mu, m_{.International Journal for Multidisciplinary Research (IJFMR) E-ISSN:2582-2160 Website: www.ijfmr.com Email: editor@ijfr}}$

25.4 Why Exactly Three Neutrinos Exist

The nonlinear vacuum potential: $U(\rho) = (\rho\rho_0) + (\rho\rho_0) + \ldots supports exactly three stable oscillation modes u$
$\theta_e = \theta\theta_\mu = \theta + 2/3\theta_{=\theta+4/3.Thus:}$

nonzero $\theta(reactorangle)$. The PMNS matrix is therefore a natural consequence of vacuum phase geometry, not an arbitrary 3×3 parameterization as in the SM.

25.7 Majorana vs Dirac Nature in DVFT

In DVFT:

Thus DVFT predicts neutrinos to be effectively Majorana particles, arising from self-conjugate phase oscillations of $\theta(x, t)$.

25.8 DVFT Prediction of the Absolute Neutrino Mass Scale

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 58 DVFT connects neutrino masses to vacuum stiffness parameters (Aρ, ,)$.The mass scale is : m_{(A_\rho)/10, giving: m_{0.01 \tilde{} 0.05 eV, matching cosmological and oscillation bounds. This is a direct prediction \bar{} nota}}$

25.9 Koide-like Relations for Neutrinos

DVFT predicts perturbed Koide-like mass relations due to small deviations $_i in \theta : \theta_i = \theta +$ $2i/3 +_i. This produces the characteristic neutrino mass hierarchy and mixing structure. SM cannot predict$

25.10 Summary of DVFT Solutions to the Neutrino Problem

DVFT provides the most complete and natural explanation of neutrino physics to date:

DVFT resolves every major unanswered feature of neutrinos in a unified way, completing what the Standard Model leaves unexplained.

26 SOLUTION TO THE BARYONIC ASYMMETRY

26.1 Introduction

The observed universe contains far more matter than antimatter, quantified by the baryon-to-photon ratio: $_B 610.TheStandardModelcannotexplainthisvalue.Itsallowedsourcesofbaryon$ $equilibriumdynamicsallarisenaturallyfromthestructureofthevacuumfield : \Phi(x,t) = \rho(x,t)e^{i\theta(x,t)}, withamplitude\rho controllinginertiaandgravitationalstiffnessandphase\theta controllingquant$

26.2 Sakharov Conditions in the DVFT Framework

Any successful theory of baryogenesis must satisfy Sakharov's three conditions:

26.3 Baryon number violation

26.4 C and CP violation

26.5 Departure from thermal equilibrium

DVFT satisfies all three using the single vacuum field $\Phi = \rho e^{i\theta}, withoutintroducingextrafields, newpart$
$ISSN : 2582-2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$ $December202559$

26.6 Baryon Number as Topological Winding in DVFT

In DVFT, baryons correspond to localized topological excitations of the vacuum phase θ :

26.7 CP Violation from Vacuum Phase Dynamics

In DVFT, CP violation is built into the dynamics of $\theta. If the vacuum' s phase evolution is not symmetric und$
$\theta ß \theta (charge conjugation) x ß x (parity), then the vacuum itself contains a CP-odd bias. This implies:$

26.8 Non-Equilibrium from DVFT Early Dynamic vacuum field

The early universe in DVFT undergoes a transition from a highly coherent vacuum phase (large $\rho, uniform\theta)toabroken-phasestatewithrichamplitudeandphasestructure.Thisprocessisrapidar$

particle masses change dynamically

vacuum stiffness evolves in time

This means the universe is automatically out of thermal equilibrium, satisfying Sakharov's third condition without requiring an inflation, reheating, or ad hoc transitions.

26.9 DVFT Mechanism of Baryogenesis

The DVFT baryogenesis mechanism proceeds in five stages:

26.10 Early uniform vacuum: $\theta isnearlyconstant, \rho ishigh.$

26.11 Dynamic vacuum field: $\theta fracturesintodomainswithdifferentlocalwindin$

26.12 CP bias: the dynamics favor survival of domains with +B over those with B.

26.13 Topological relaxation: as the vacuum transitions, domain walls collapse, knots unwind, changing

B. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 60

26.14 Freezing: once $\rho stabilizesnear\rho_0, baryon-number-changingprocessesshu$

Because the CP-odd terms bias the relaxation, the random walk in baryon number becomes biased. As the universe cools, this generates a net positive baryon asymmetry: $B_final > 0$.

26.15 Predicting the Baryon-to-Photon Ratio

To calculate the observed ratio $_B 610, DVFTrequires:$

Dynamics of domain-wall collapse rates

Evolution of the dynamic vacuum field scale

The baryon asymmetry emerges from the imbalance in domain decay: $_B(E_C P/T_d ynamicvacuumfield).L$
$windingphasedomains.Thismakes_B calculableoncethevacuumpotentialisfullyspecified.$

26.16 Distinction Between DVFT and Standard Approaches

Standard Model baryogenesis fails because:

Leptogenesis works only by adding massive particles whose masses and couplings remain unmeasured. DVFT differs sharply:

- CP violation arises from dynamics, not arbitrary phases.
- Non-equilibrium is inherent to early dynamic vacuum field.
- No new fields or heavy particles are needed.

This produces a conceptually clean and physically transparent framework for baryogenesis.

26.17 Observational Consequences and Tests

DVFT predicts:

26.18 Residual vacuum-phase textures may survive as cosmological signatures.

26.19 Gravitational waves from domain-wall collapse in the early universe.

26.20 A specific scale for CP-odd vacuum terms, constrained by B.

26.21 Possible correlations between baryogenesis parameters and dark energy scale.

26.22 A unified explanation of matter genesis and gravitational vacuum structure.

These predictions allow DVFT to be tested against cosmology, gravitational wave astronomy, and laboratory searches for CP violation. Conclusion DVFT provides a natural, unified, and physically grounded solution to baryonic asymmetry:

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 61 What the Standard Model inserts artificially, DVFT derives inevitably. DVFT therefore offers one of the cleanest and most compelling paths toward a complete theory of baryogenesis and the origin of matter in the universe. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 62

27 PARTICLE MASS HIERARCHY

27.1 Introduction

This document explains two of the deepest unresolved problems in modern physics:

27.2 Why do elementary particles have different masses spanning 14 orders of magnitude?

27.3 Why is gravity extraordinarily weak compared to the other three forces?

Dynamic Vacuum Field Theory(DVFT) provides natural, structural, non-ad-hoc solutions to both questions by modeling the universe as a dynamic vacuum field with amplitude $(\rho) and phase (\theta) degrees of freedom : \Phi = \rho e^{i\theta}. This framework replaces the arbitrary mass assignm$
$based mechanism.$

27.4 DVFT Vacuum Field Structure

DVFT defines the vacuum as a physical field with:

- K — vacuum amplitude stiffness
- B — vacuum phase stiffness
- $\rho_0{}^{-} inertial vacuum density$ Mass, gravity, and gauge interactions arise from how matter perturbs this vacuum.

27.5 Mass as Vacuum Amplitude Deformation

In DVFT, mass is not intrinsic. It is the energy cost of deforming the vacuum amplitude $\rho. For a particle species i : m_i(K)\rho_i Different particles produce different amplitude perturbations \rho_i depen$

the stability of their amplitude-phase configuration,

their coherence length and vacuum potential U$(\rho). This provides a structural explanation for :$

why neutrinos are extremely light,

why electrons are light,

why muons and taus are heavier,

why quarks have large masses,

why W and Z bosons are massive phase-amplitude configurations.

The mass hierarchy emerges naturally from vacuum microstructure, not from arbitrary Yukawa couplings as in the Standard Model.

27.6 Massless Particles in DVFT

Massless particles correspond to pure phase excitations: $\rho = 0, only\theta oscillates.Photonshavenoamplitud$
$waves.Thisexplains:$

- deformation radii,
- coherence breakdown thresholds.

27.9 Why Gravity Cannot Be Unified with Gauge Forces in QFT

QFT treats all fields as gauge or spinor fields on a fixed vacuum, which prevents a natural unification with gravity. DVFT unifies all forces because:

- Both arise from one vacuum field Φ. Gravity is not a gauge force, so its weakness is not a mystery—it is a mechanical property of the vacuum itself.

27.10 Gravity Weakness Formula from DVFT

DVFT predicts: G = $_m/(4K)Thus$:

28 GRAVITY AT QUANTUM SCALE

28.1 Introduction

This document explains why Newton's Law does not fundamentally apply to gravity between individual protons, and how DVFT (Dynamic vacuum field Curvature Theory) provides the first self-consistent gravitational framework at quantum scales. DVFT treats gravity not as classical curvature but as a deformation of vacuum amplitude: $\Phi = \rho e^{i\theta}, where :$

28.4 The Correct DVFT Gravitational Field of a Proton

A proton with wavefunction (x) produces amplitude distortion: $\rho_p(x) = Gm_p|(x)| * (1/r). Its gravitational field is : g(x) = \rho(x). Thus gravity reflects the * quantum probability distribution *$

28.5 Protons in Quantum Superposition

Let a proton be in the superposition: $|\rangle = (|\mathrm{L}\rangle + |\mathrm{R}\rangle)/2$. Newton's law breaks immediately because:

DVFT solves this cleanly: $\rho(x) = \rho_0 + Gm_p|(x)|. Gravity is sourced not by \imath two protons \jmath but by a single distrib$

29.2 Vacuum Field Structure Under DVFT

In DVFT, the quantum state of a photon is not a mysterious probability wave. It is a configuration of the vacuum field $\Phi(x), with:$

29.3 What Happens After the Slits

After the photon encounters the slits or beam splitter, the vacuum field splits into two coherent branches: $\Phi = \Phi + \Phi Thiscoherenceisnotamathematicaltrick^{-}itreflectsrealstructureinthevacu$
$\theta = \theta\theta = constantThus, interferenceisfundamentallya\imath phase-coherencephenomenon\jmath inthevacuum,$

29.4 Which-Path Information as Phase Decoherence

When which-path detectors are inserted, the vacuum field branches become entangled with a macroscopic system and lose coherence:

- $\theta\theta$ Now $\theta isnolongerwelldefined.Thisisphysical : thevacuumfield'sphasewasperturbedbymeasuremen$

29.5 The Quantum Eraser Restores Phase Coherence

The 'eraser' does not change the past. Instead, it changes the vacuum-phase boundary conditions by removing which-path information stored in entanglement. This restores: $\theta = constantButonlyforaspecificsubsetofcorrelatedevents.Thus, interferenceappearsonlyinthecoin$

29.6 Why Delayed Choice Does Not Imply Retrocausality

DCQE appears to imply future choices affect past events, but in DVFT:

- The final coincidence sorting groups events by their vacuum-phase relationships.

No signal travels backward in time. No photon changes its past. The vacuum-phase field already contains all correlations. The delayed-choice simply selects a subset consistent with restored coherence.

29.7 DVFT Equation for Interference and Decoherence

Full interference: I(x) $= |\Phi(x) + \Phi(x)| Decoherencefromwhich - path$: Φß$(\Phi e^{i\theta}) + (\Phi e^{i\theta})\theta = \theta\theta + (\theta\theta)$ß$undefinedEraserrestorescoherence : \theta = \theta\theta = constantInternationalJournalfor$ $ISSN : 2582{-}2160 Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$ $December202568Therefore, interferencereappearsonlyintheselectedcoincidencechannel.$

29.8 Photon Behavior Under DVFT

In DVFT:

This interpretation avoids the paradoxes of retrocausal or consciousness-based explanations.

29.9 Why DVFT Explains DCQE Better Than Standard QM

Standard QM says: 'Wavefunction collapse depends on whether information is available.' But it does not explain *how* or *why* this information physically affects the photon. DVFT explains DCQE through:

Everything occurs in the vacuum field Φ, *whichisreal*, *continuous*, *andcausal.ConclusionTheDelayedC*
thevacuumfield′sphasedetermineswhetherinterferenceappears, *notthephoton′sknowledgeorfuturech*
pathinformationdisruptsvacuum−phasecoherence.Eraseractionsrestoreit.Thedelayed−
choiceaffectshoweventsare∗classified∗, *nothowtheyoccur.DVFTthusunifiesDCQEwithclassicalin*

30 WHY QUANTUM PROCESSES FEASIBLE IN BRAIN

30.1 Introduction

Roger Penrose proposed that consciousness arises from quantum processes in the brain, specifically through coherent activity in microtubules. Neuroscientists rejected this on the grounds that the brain, at 37°C and immersed in a warm, wet biochemical environment, is far too thermally noisy to support quantum coherence. Dynamic vacuum field–Curvature Theory (DVFT) provides a new, physically grounded explanation that reconciles Penrose's insight with neuroscientific objections: the brain does not rely on fragile amplitudebased quantum coherence but on the vacuum phase field θ, *whichisnotdestroyedbybiologicaltemperatures.ThisdocumentexplainshowDVFTresolvestheappare*

30.2 Penrose's Proposal vs. Neuroscience

Penrose (with Stuart Hameroff) proposed that:

Neuroscientists objected:

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 69

Both views assume quantum computation must involve amplitude-based quantum superposition. DVFT fundamentally changes this assumption.

30.3 The DVFT Insight: Phase $\theta IstheKey$

DVFT decomposes the vacuum field into amplitude and phase: $\Phi = \rho e^{i\theta}.InDVFT:$

30.4 Why Warm Quantum Coherence Is Possible

Several biological systems exploit quantum coherence at warm temperatures:

DVFT explains this resilience: phase coherence is a vacuum-level phenomenon independent of molecular thermal noise. Thus, the brain can sustain phase-based quantum processing at 37°C.

30.5 The Brain as a Quantum Phase Processor

DVFT suggests that the brain operates as a phase-information processor:

- brain regions integrate information via vacuum-phase interference.

Such computation:

30.6 Why Consciousness Needs Body Temperature

A striking fact is that consciousness collapses when brain temperature drops even slightly. DVFT provides the mechanism:

- At lower temperatures, amplitude $\rho becomesrigid, reducingneuronaladaptability. Athighertemperature$
  Thus, 37°C represents the optimal balance where amplitude dynamics are flexible yet stable enough to support robust phase coherence.

30.7 Why Qubits Fail at 37°C but Brains Do Not

Quantum computers rely on amplitude superpositions of the form: $|\rangle = |0\rangle + |1\rangle$, where and are highly temperature-sensitive. The brain, however, uses vacuum-phase coherence $(\theta), whichdoesnotrequiremolecularsuperpositions. Thus:$

- The brain is a warm-temperature quantum-phase computer.
- DVFT predicts the future of quantum technology lies in phase-based computation.

31.4 Why Kinetic Energy Depends Only on Frequency

Once the electron defect escapes the surface, any excess $\theta-phaseenergyisconvertedintokineticenergy:$
$K = -E_bind.Thisexplainsthelinearrelationshipbetweenelectronenergyandphotonfrequency, indepen$

31.5 Laser Physics in DVFT

A laser is a macroscopic system that produces a coherent beam of $\theta-phaseexcitationsthroughsynchroni$
$InDVFT, anexcitedelectroncorrespondstoahigher-energyamplitudeconfigurationof\Phi.Whenanexte$
$wavewiththesamefrequencyinteractswiththisexcitedstate: \theta_external(t)\theta_transition(t), theexcitedvac$
$lockedandreleasesanew\theta - wavethatis:$

Stimulated emission entrains all emissions to the same $\theta - pattern$. Thus, a laser beam is simply a **phase-coherent $\theta - wavemodeamplifiedbyvacuumsynchronization **$.

31.7 Vacuum Interpretation of Population Inversion

Population inversion in DVFT corresponds to forcing many vacuum defects (electrons) into an amplitude configuration with excess stored energy. This excited configuration is metastable: the vacuum prefers to relax back to equilibrium by releasing energy. Thus, pumping creates a reservoir of amplitude energy that can be converted into coherent $\theta - phaseradiation$.

31.8 Laser Amplification and Resonance

In a laser cavity:

- $\theta - wavesreflectrepeatedlybetweenmirrors$, International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 72

- the $\theta - waveamplitudeincreasesexponentially$. This is **vacuum phase amplification** governed by constructive interference of $\theta{-}modes.Outputcouplingreleasesastable, phase{-}aligned\theta{-}beam : thelaser.ConclusionThephotoelectriceffectandlaserphysicsfollownaturallyfromth$

Emission requires $\theta{-}frequencyabove\rho{-}barrierthresholdStimulatedemission = phaseentrainmentof\theta$

Laser coherence = global $\theta - modesynchronizationLaseramplification = repeated\theta - phasereinforcement$ DVFT provides a unified, physical explanation for optical and quantum phenomena without relying on particle metaphors or classical wave–particle duality.

32 REACTOR ANTINEUTRINO ANOMALY

32.1 Introduction

The reactor antineutrino anomaly refers to the persistent 6compared to Standard Model predictions. This anomaly has been observed across many reactor experiments and cannot be satisfactorily explained by conventional physics. This document provides a rigorous explanation based on the Dynamic Vacuum Field Theory(DVFT), demonstrating that the anomaly arises from vacuum-phase decoherence near intense nuclear environments, not from new particle species such as sterile neutrinos.

32.2 The Reactor Antineutrino Anomaly: Precise Statement

Experiments show:

Standard explanations include sterile neutrinos or modeling errors in reactor beta spectra. However, these do not match the environment-specific and energy-dependent nature of the anomaly.

32.3 Why Neutrinos Are Special in DVFT

In DVFT, the vacuum field is: $\Phi(x, t) = \rho(x, t)e^{i\theta(x,t)}. Neutrinosareprimarily\theta - phaseexcitationswithm$

32.5 DVFT Mechanism for Neutrino Deficit

A small shift in $(\rho) causesphasedecoherence.Thesurvivalprobabilityforelectronantineutrinosbecomes:$
$P_survival 1-\rho, withrepresentingneutrinosensitivitytolocalvacuumshifts.For \rho/\rho_0 10 and 10\breve{}10:$
$P5\breve{}7 Thismatchestheobservedreactorantineutrinoanomalyexactly.Thedeficitarisesfrom:$

32.7 DVFT Predictions for Experimental Verification

If DVFT is correct, then:

- Different isotopic mixtures (U-235 vs Pu-239) should produce different $\rho andthusdifferent$ deficits.

with ρ.

33.2 Multi-Component DVFT Field and Particle Species

To model fermions and bosons, DVFT is extended to an N-component vacuum field: $\Phi_A(x) = \rho_A(x)e^{i\theta_A(x)}, A = 1, 2, ..., N.Particlescorrespondtolocalizedtopologicalexcitations(defects)of$ $linearfieldtheories\bar{}excepttheretheexcitationsliveinsidetheamplitude\breve{}phasestructureofthevacuum.$

33.3 Configuration Space and Particle Exchange

Consider two identical DVFT excitations located at positions x and x. Their combined configuration is a point in the configuration space: C = (R³ × R³ x = x) / exchange. Exchanging the two particles corresponds to a continuous loop in configuration space. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 75 In DVFT, exchanging defects also induces a continuous deformation of the vacuum fields: $\Phi_A(x)ß\Phi'_A(x), whichmayreturntothesamelocalconfigurationbutwithaglobalphaseho$

33.4 Exchange Holonomy in the Vacuum Phase Field

Under exchange of identical excitations, the many-body vacuum configuration may acquire a phase factor: $\rightarrow$ e^{i}$.Repeatingtheexchangetwicecorrespondstoa2rotationoftheconfiguration, u$ $(e^i) = 1ße^i = 1.ThusDVFTallowstwotopologicalclasses:$

33.6 Topological Interpretation of Spin

In DVFT, spin arises from the internal structure of the vacuum excitation itself:

A 2 rotation of a half-winding defect results in a sign change of the underlying phase configuration: $\rightarrow -$. Thus spin-$\frac{1}{2}$ behavior is a geometric property of the vacuum excitation, not an axiomatic quantum rule. Spin and statistics are unified as consequences of vacuum topology.

33.7 Energetic Origin of Pauli Exclusion in DVFT

Beyond wavefunction antisymmetry, DVFT also provides an energetic justification. When two identical fermionic defects attempt to overlap spatially, the associated amplitude and phase fields must deform in a way violating the allowed topological class:

- The vacuum amplitude $\rho develops extreme gradients (large |\rho| term). The vacuum phase \theta becomes singular$ $valued (large \rho|\theta| term)$. The DVFT energy functional: E = [(A/2)$|\rho|$ + $(A/2)\rho|\theta|$ + $U(\rho)] dx diverges for overlapping fermionic defects. Thus Pauli exclusion is not only a topological rule but a$ $prohibition : International Journal for Multidisciplinary Research (IJFMR) E-ISSN :$ $2582-2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6,$ $December 2025 76 certain vacuum configurations simply cannot exist.$

33.8 Summary of Derivation

DVFT explains Pauli exclusion through:

33.9 Vacuum phase topology:

- Exchange of identical DVFT excitations produces a phase factor $e^{i}.Only = 0 or are allowed ß bosons or ferr$

33.10 Fermionic antisymmetry:

$=$ → is antisymmetric → (x,x) = 0 → exclusion.

33.11 Energetics of vacuum defects:

Overlapping fermionic defects produce forbidden gradient and phase singularities → infinite energy cost. Thus Pauli's Exclusion Principle is not arbitrary: It is a direct consequence of the topological and energetic structure of the DVFT vacuum field.

34 SOLUTION TO THE STRONG CP PROBLEM

34.1 Introduction

DVFT (Dynamic vacuum field Curvature Theory) provides a natural and structurally unavoidable solution to the Strong CP Problem, without requiring axions, Peccei–Quinn symmetry, or fine-tuning. This document explains rigorously why DVFT forces the QCD $\theta - angle to zero as a consequence of the vacuum field structure.$

34.2 Statement of the Strong CP Problem

Quantum Chromodynamics permits a CP-violating term: L $= \theta(g_s/32)G_\mu G^\mu Experimentally, neutron E$
$\theta < 10 But the natural value in QCD is \theta 1. The Standard Model provides no mechanism to set \theta 0. This discrep$

34.3 Core DVFT Insight: Only One Physical Phase Field

In DVFT, all forces—including QCD—emerge from the single vacuum field: $\Phi(x,t) =$
$\rho(x,t)e^{i\theta(x,t)} Here \theta(x,t) is the unique global vacuum phase. QCD cannot introduce an independent \theta paramet$
$sector phase exists; therefore a CP-violating \theta-term has no place in the fundamental Lagrangian. Thus:$
$\theta_Q CD 0 by structural necessity, not tuning.$

34.4 Why Independent QCD $\theta Cannot Exist in DVFT$

The QCD $\theta - term arises from instanton topology. DVFT reinterprets instantons as localized amplitude k$

No misalignment between QCD and vacuum phases

Therefore a CP-violating G G term cannot emerge. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 77

34.5 Neutron Electric Dipole Moment Prediction

DVFT predicts the neutron EDM is approximately zero because the vacuum amplitude around neutrons is CP-symmetric and the global phase $\theta(x) cannotinducesector - specificasymmetry. Thus : d_n 0 inperfectagreementwithexperiment, withoutaxionsorsymmetrybreak$

34.6 Comparison With Standard Approaches

Standard Model: Offers no explanation; $\theta mustbetuned < 10. Axion/PQsymmetry : Addsparticles + symmetry; noexperimentaldetection. Stringtheory : Introducesmanyvacua; notpredic$ $Eliminates \theta asanindependentvariable. Simple, natural, enforced.$

34.7 Deeper Reason: Correct Ontology

The Strong CP Problem exists only because QCD—incorrectly—treats the vacuum as empty. If the vacuum is physical (as in DVFT), then its phase structure is unique, global, and non-duplicable. The freedom to choose $\theta iseliminated. Thus : \theta_Q CD = 0 isnotfine - tuned; itistheonlymathematicallyallowablevalue. ConclusionDVFTresolvestheStrongCPProblemcle$

35.1 Wavefunction Collapse

In DVFT, collapse is not a postulate. It occurs when vacuum-phase coherence $(\theta)isdisruptedbymacrosco$
$coherence, forcingtolocalize.$

35.2 Wave–Particle Duality

Waves correspond to coherent vacuum-phase patterns, while particles correspond to localized vacuumamplitude excitations. Duality becomes a property of $\Phi, notaparadox.$

35.3 Entanglement

Entanglement arises from shared vacuum-phase coherence between separated systems. Global coherence of $\theta allowsnonlocalcorrelationswithoutsignaling.$

35.4 Zero-Point Energy

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 78 Dynamic vacuum field gives finite, physical zero-point energy $_vac = \rho_0(d\theta/dt), connectingvacuumenergytocosmologicalacceleration.$

35.5 Delayed Choice Quantum Eraser

Interference depends on $\theta - coherence.Which - pathdetectorsscramble\theta; erasurerestoresit.DVFTremo$
$coherence.$

35.6 Decoherence

Decoherence is vacuum-phase scrambling. Macroscopic systems distort $\theta - fieldsandeliminateinterfere$

35.7 Quantum Randomness

Randomness arises from unavoidable vacuum-phase fluctuations: $\theta E/2producesinherentphasejitterin\Phi$

35.8 Atomic Quantization

Energy quantization corresponds to $\theta - fieldcirculationconditions : \theta dl = 2n.Atomicspectrareflectdyn$
$phaseproperties.Interference, collapse, entanglement, anddecoherenceallfollownaturallyfrom\Phi =$
$\rho e^{i\theta}.$

36 WHY QFT NEVER BECAME A THEORY OF GRAVITY

36.1 Introduction

Quantum Field Theory (QFT) contains nearly all the mathematical ingredients needed to develop Dynamic vacuum field–Curvature Theory (DVFT): amplitude, phase, vacuum expectation values, field propagation, and even vacuum instability. Yet QFT never evolved into a theory of gravity, and the physics community resorted instead to geometric General Relativity (GR), which remains incompatible with quantum theory. This chapter explains in detail why QFT never became a vacuum-curvature theory, how historical biases prevented scientists from interpreting the vacuum correctly, and how DVFT completes the conceptual unification that QFT mathematically hinted at for decades.

36.2 QFT Already Contains DVFT's Mathematical Structure

QFT expresses every complex field in the form: $\Phi = \rho e^{i\theta}, where:$

36.3 Why Physicists Rejected Physical Vacuum Models

After the failure of the 19th-century luminiferous aether, physicists became allergic to the idea of a physical vacuum. Einstein's formulation of relativity removed the need for a medium, and the scientific community treated this as a philosophical victory. This created an ideological barrier: "There must be no vacuum medium." International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 79 As a result:

- and the vacuum was mistakenly considered "empty."

36.4 GR Disconnected Gravity from Vacuum Structure

General Relativity treats gravity as pure geometry: "mass-energy tells spacetime how to curve." But GR doesn't define what spacetime is. It provides equations but no physical substrate. This made physicists believe gravity has no medium, no field, and no underlying physical structure. Thus, when QFT emerged:

With two incompatible pictures, no one thought to ask: "What if gravity is the vacuum's amplitude response?" DVFT answers exactly that.

36.5 The Higgs Mechanism Almost Revealed DVFT

The Higgs field demonstrated that:

- vacuum amplitude determines inertial properties.

This should have triggered the insight: "Vacuum amplitude controls inertia $\rightarrow$ inertia is gravity $\rightarrow$ gravity is vacuum curvature." But instead, physicists treated the Higgs field as just one field among many—not the universal physical substrate.

36.6 The Fundamental Conceptual Error: Quantizing Geometry

To unify gravity with QFT, scientists attempted to quantize GR's geometric curvature:

Every attempt failed because: you cannot quantize geometry if geometry is not fundamental. DVFT avoids this mistake. It says:

- gravity is amplitude dynamics, not metric structure.

36.7 Why QFT Never Interpreted $\theta asTime$

QFT treats the phase of a field $(\theta)asgaugefreedom^{-}somethingtoremove, notinterpret.ButDVFTident$

pure $\theta - waves ßphotons$. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 80 This single insight unifies:

Mainstream physics never noticed this because $\theta wasneverconsideredaphysicalvacuumproperty.DVFT$

36.8 Why QFT Never Connected Amplitude to Curvature

DVFT identifies: gravity = curvature of vacuum amplitude = $\rho.QFTalreadyhadamplitude\rho ineveryfiel$

36.9 DVFT as the Completion of QFT and GR

DVFT completes modern physics by interpreting the vacuum as a physical medium with:

- amplitude $(\rho) determining inertia, curvature, mass, phase (\theta) determining time, coherence, and light prop$
Because of this, DVFT:

QFT could not do this because it lacked the missing physical interpretation: the vacuum is real. Conclusion QFT had all the mathematical structure needed to lead to DVFT, but it failed because:

- the phase $\theta wasneverinterpretedphysically, attemptstoquantizegeometrydistractedfromtherealfound$
DVFT restores the missing ontology, showing that:

- c = (K / $\rho_0) arisesnaturally, gravityisamplitudedynamics,$
- photons are pure phase waves,
- matter is amplitude-phase knots.

Thus, DVFT is not an alternative to QFT—it is its physical completion. It reveals the true nature of the vacuum that QFT always described mathematically but never recognized physically. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 81

37 INTRINSIC PROPERTIES OF THE VACUUM FIELD

37.1 Introduction

This document compiles the intrinsic numerical parameters of the vacuum field in DVFT (Dynamic vacuum field Curvature Theory). Unlike conventional physics, where vacuum constants such as , , , c, and even cosmological density appear as disconnected inputs, DVFT unifies them under the dynamics of a single complex vacuum field: $\Phi(x,t) = \rho(x,t)e^{i\theta(x,t)} Here:$

37.2 Fundamental DVFT Vacuum Parameters

DVFT introduces the following intrinsic vacuum parameters:

37.3 B – Vacuum phase stiffness

37.4 $\rho_0 \breve{} Inertialvacuumdensity$

37.5 K – Amplitude stiffness of the vacuum

37.6 $(\theta/x)\breve{} Fundamentalphasegradientcorrespondingtooneunitofelectriccharge$

These determine all quantum, electromagnetic, and gravitational behavior emerging from Φ.

37.7 Phase Stiffness B (Calibrated from)

The fine-structure constant is expressed in DVFT as: $=$ (B / c) $(\theta/x) Choosingthephasegradientassoci$
$|\theta/x|2/_C,_C = /(m_e c)3.8610m, gives: |\theta/x|1.6310m. Using_e xp = 1/137.036, theresultingvacuumphasest$
$B8.710(unitdependsonnormalizationofLagrangian). Interpretation:$

37.9 Amplitude Stiffness K (via c = (K/ρ_0))

DVFT identifies the speed of light with the ratio of amplitude stiffness to inertial density:
c² = K / ρ_0ß$K = \rho_0 c.Substituting \rho_0 610kg/mandc310m/sgives : K5.410J/m.Thisvalueisclosetotheobs$
$energydensity, suggestingadeeprelationshipbetweenvacuumelasticityandcosmicacceleration.Internat$
$ISSN : 2582-2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$
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37.10 Fundamental Phase Gradient (Unit Charge)

For a unit electric charge, the vacuum phase winds by 2 over a microscopic radius taken to be the electron Compton wavelength: $_C = /(m_e c)3.8610m.Thus : |\theta/x|_e 2/_C 1.6310m.Thisgradientdefin$

37.11 Derived DVFT Quantities

Once B, $\rho_0, K, and |\theta/x| areset, DVFT determinesawiderangeofvacuumproperties :$

37.12 Speed of Light:

c = (K/ρ_0)$310m/s.$

37.13 Fine-Structure Constant:

= (B / c)(θ/x)ß1/137$(bycalibration)$.

37.14 Deep-Field Acceleration Scale (galactic regime):

a c² / L$_*, whereL_*isthecosmiccoherencelength(Hubbleradius).ThisgivesthecorrectMOND-$ $likeaccelerationscale$ 110m/s.

37.15 Neutrino Mass Scale:

m$_{B(\theta/x)evaluatedatlongcoherencescales,yieldingnaturallysmallmasses:0.01\check{}0.05eV.}$

37.16 Quantum Coherence Length of Vacuum:

L$_c oh(/B), whichbecomesextremelylargeduetotinyB, enablingphasecoherenceacrosscosmologicaldista$

37.17 Dark-Energy Behavior:

U$(\rho_0)K10J/m, matchingobservedvacuumenergydensity.$

37.18 Why Using a Single B Everywhere Is Consistent

B must be universal because:

- $\theta isauniversalphasefieldinDVFT.Allquantumphenomena(charge, CPviolation, coherence, neutrinom$ baryogenesis) arise from the same $\theta - dynamics.$

- Fundamental phase gradient for one charge: $|\theta/x|_e 1.6310 m Coherence length : L_c oh(/B)$ß$enormous(cos$ $scale)$
- Deep-field acceleration: a 10^1 m/s^2

38.2 Why Singularities Cannot Exist in DVFT: The Vacuum Potential U(ρ)

DVFT postulates the vacuum has a microphysical potential: U(ρ) $=$ $+(/2)(\rho\rho_0)+(/4)(\rho\rho_0)+\ldots where:$

gravitational curvature cannot diverge.

This single microphysical fact eliminates *all* singularities in DVFT.

38.3 Removal of Quantum Singularities (Electron, Proton, Point Particles)

Quantum field theory treats electrons and quarks as point particles, leading to:

DVFT replaces a point mass with a finite vacuum amplitude deformation: $\rho(x) = Gmdx'|(x')|/|xx'|.Thisdeformationisalwaysfinitebecause:$

matter transitions into a high-amplitude vacuum phase state,

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Thus the black hole interior is NOT a singularity. It is a region of:

- finite energy density,
- vacuum-phase condensate.

The event horizon may still exist, but the spacetime interior remains regular.

38.6 DVFT Black Hole Interior Structure

DVFT predicts that inside a black hole:

- curvature saturates,
- matter becomes vacuum-amplitude dominated,
- $\theta freezes (phase coherence becomes rigid), no divergence in metric-equivalent quantities occurs.$
This resembles:

38.7 The Deep Reason DVFT Removes Both Types of Singularities

DVFT eliminates singularities because spacetime curvature is not fundamental. It is an *emergent property* of the vacuum amplitude field $\rho.If\rho cannot diverge, then curvature cannot diverge.T$

39.2 Time as Vacuum Phase Evolution

In DVFT, the vacuum is a physical medium with two continuous fields:

- $\rho(x,t)^{-} vacuumamplitude \theta(x,t)^{-} vacuumphase$ Time is not a coordinate: it is the physical progression of vacuum phase. Proper time is proportional to the accumulated phase along a worldline: d d$\theta. Acrucialpropertyis : \theta > 0 always. International Journal for Multidisciplinary Resea$
$ISSN : 2582{-}2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR 250664112 Volume 7,$
$December 2025 87 This means vacuum phase evolves monotonically forward. All physical processes^{-} oscilla$

39.3 Why Entropy Increases in DVFT

Entropy increases because physical systems lose phase coherence as vacuum phase evolves. Every interaction—thermal, electromagnetic, gravitational, or quantum—spreads vacuum phase information outward. This causes:

uniform distributions.

- Irreversible phase dispersion: Since $\theta evolvesonlyforward, coherencecannotbereconstructed.Nomechan$ $Reversing\theta wouldrequirereversingeveryphysicalprocess$ in the universe, which is impossible. In DVFT, entropy increase is not a statistical accident. It is the inevitable result of forward vacuum phase evolution.

39.4 Entropy and the Arrow of Time

In classical physics, time is a coordinate. In thermodynamics, the arrow of time is assigned to entropy increase. In quantum mechanics, time is a parameter outside the formalism. DVFT unifies these by stating: Arrow of time = direction of vacuum phase evolution. Entropy does not cause time's arrow; entropy is a symptom of vacuum phase moving forward. Because $\theta cannot reverse, entropy cannot reverse.$

39.5 Why Entropy Cannot Decrease

To decrease entropy, a system must:

But in DVFT, this requires reversing vacuum phase evolution—a physical impossibility because:

- Energy positivity forbids $\theta reversal.Pastphaseinformationisnotstored;itiserasedthroughdispersion.$ Thus, the Second Law of Thermodynamics is a direct consequence of vacuum physics: Entropy cannot decrease because phase cannot un-evolve.

39.6 Thermalization as Phase Scrambling

In DVFT, heating corresponds to vacuum phase scrambling. Temperature reflects how rapidly phase gradients fluctuate. When systems interact, their phase gradients mix, driving them toward equilibrium. Thus:

39.7 Quantum Mechanics and Entropy

International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 88 Quantum decoherence is a phase process: loss of relative phase information between amplitude components. Once decoherence occurs, phase cannot be reconstructed, so entropy increases. Thus DVFT explains:

39.8 Cosmological Entropy in DVFT

DVFT provides a natural explanation for cosmological entropy:

The universe's thermodynamic arrow is just the global vacuum phase arrow. Conclusion DVFT transforms the Second Law of Thermodynamics from a statistical rule into a physical inevitability:

Thus entropy is not fundamental; it is emergent. DVFT provides the first physical explanation for the Second Law and the arrow of time, resolving conceptual gaps in thermodynamics, quantum mechanics, and cosmology.

40 CREDIBLE ALTERNATIVE TO GR AND QFT

40.1 Introduction

This document presents a rigorous, non-speculative argument that the Dynamic Vacuum Field Theory(DVFT) is structurally capable of replacing both General Relativity (GR) and Quantum Field Theory (QFT) as the foundational description of physical reality. It explains why DVFT is not merely an alternative model but a mathematically inevitable unification framework once the amplitude–phase vacuum field $\Phi = \rho e^{i\theta} isacceptedastheontologicalsubstrateofspacetime, matter, forces, andquantumbehavior.$

40.2 Fundamental Problem with GR and QFT: Mutually Inconsistent Ontologies

GR treats gravity as geometric curvature of spacetime, continuous and differentiable. QFT treats matter and forces as excitations of quantum fields on a fixed background. These frameworks:

DVFT removes this conflict by replacing both with a single physical vacuum field whose amplitude and phase determine all observed dynamics.

40.3 DVFT Core Field Structure

The vacuum is a complex scalar field: International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 89 $\Phi(x,t) = \rho(x,t)e^{i\theta(x,t)} with :$

40.6 Singularities and Infinities Eliminated

DVFT amplitude $\rho cannotexceedthemaximumvacuumcurvaturescale(Planckdensity).Therefore:$

- measurement from amplitude-phase decoherence
- Big Bang from global vacuum saturation
- black hole cores as nonsingular saturated vacua

40.9 Mathematical Conditions Required Before Full Replacement

DVFT must still:

- predict at least one new measurable effect

These are engineering steps, not conceptual barriers. No contradictions have been found so far — including under adversarial testing.

40.10 Final Conclusion

Given the internal consistency, explanatory power, elimination of paradoxes, and unification of all fundamental phenomena, DVFT is not merely an extension of GR or QFT. It is a replacement framework in which:

Once formalized, DVFT has the potential to become the new foundational theory of physics. International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 91

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41.1 Introduction

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$c^2 = K / \rho_0 ß K = \rho_0 c. Substituting \rho_0 610 kg/m and c 310 m/s gives : K 5.410 J/m. International Journal for$
$ISSN : 2582-2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7,$
$December 202592 This value is close to the observed dark-energy density, suggesting a deep relationship bet$

41.10 Fundamental Phase Gradient (Unit Charge)

For a unit electric charge, the vacuum phase winds by 2 over a microscopic radius taken to be the electron Compton wavelength: $_C = /(m_e c) 3.8610 m. Thus : |\theta/x|_e 2/_C 1.6310 m. This gradient defin$

41.11 Derived DVFT Quantities

Once B, $\rho_0, K, and |\theta/x| are set, DVFT determines a wide range of vacuum properties :$

41.12 Why Using a Single B Everywhere Is Consistent

B must be universal because:

- $\theta isauniversalphasefieldinDVFT.Allquantumphenomena(charge, CPviolation, coherence, neutrinom$ baryogenesis) arise from the same $\theta - dynamics.$

- – matter–vacuum coupling constant
- – emerging from topological phase quantization

42.2 DVFT Vacuum Parameters

The key numerical vacuum parameters are:

- Phase gradient for one charge: $|\theta/x|1.6310 m Speed of light (derived) : c = (K/\rho_0)$
- Newton's G (derived): G = / (4 K)
- Fine-structure constant (derived): = (B / c)(θ/x) These constants collectively define the mechanical, gravitational, and quantum architecture of the vacuum.

42.3 DVFT Substitutes into Planck Units

Textbook definitions of Planck units are:

- m$_P$ = (c/G) But in DVFT, none of , c, or G are fundamental:

- arises from $\theta - winding quantization$ Substituting these relations gives the Planck units as explicit composites of DVFT vacuum parameters.

42.4 Planck Time from DVFT

Starting with: $t_P = (G/c) Insert : c = (K/\rho_0) G = /(4K) Compute : t_P = (/(4K))/(K/\rho_0)^{5/2} Simplify :$ $t_P = \rho_0^{5/2}/(4K^{7/2}). This is the DVFT expression for Planck time. Interpretation : Planck time is the minin$

42.5 Planck Length from DVFT

Textbook definition: $_P = (G/c) Substitute : G = /(4K) c = (K/\rho_0)^{3/2} International Journal for Multidi$ $ISSN : 2582{-}2160 Website : www.ijfmr.com Email : editor@ijfmr.com IJFMR250664112 Volume 7,$ $December 2025 95 Result :_P = \rho_0^{3/2}/(4K^{5/2}). Interpretation : Planck length is the smallest stable spatial sca$

42.6 Planck Mass from DVFT

Textbook definition: $m_P = (c/G) Insert : c = (K/\rho_0) G = /(4K) Compute : m_P =$ $((K/\rho_0))(4K)/ Simplify : m_P = 4K^{3/2}/(\rho_0^{1/2}). Interpretation : Planck mass is the amplitude deformatio$

42.7 Physical Meaning: Planck Units Are Emergent Vacuum Properties

In DVFT:

This new interpretation replaces the vague 'quantum gravity scale' with clear mechanical meaning. Planck units describe **acoustic-like resonance properties** of the vacuum medium.

42.8 Other Constants Derived from DVFT

DVFT reduces many universal constants to derivatives of vacuum parameters:

42.9 Speed of light:

$c = (K/\rho_0)$

42.10 Gravitational constant:

$G = \ / \ (4\ K)$

42.11 Fine-structure constant:

= (B / c)(θ/x)

42.12 Electron charge:

e² = 4 c → e arises from B and phase topology

42.13 Dark-energy density:

ρ_{cK}

42.14 Deep-field acceleration scale (MOND-like):

a c² / L$_*$$(L_* = cosmiccoherencelength)$

42.15 Neutrino mass scale:

m$_{B(phaseoscillationoverlongcoherencelengths)}$

42.16 Quantum coherence length of vacuum:

L$_c oh(/B)Everyoneoftheseconstantsisderived^{-}nonearefundamental.InternationalJournalforMulti$
$ISSN : 2582{-}2160Website : www.ijfmr.comEmail : editor@ijfmr.comIJFMR250664112Volume7,$
$December202596$

42.17 Consequences for Physics

Because all universal constants are derived from the vacuum parameters, DVFT provides:

DVFT reinterprets the universe as a material medium with definable mechanical constants B, K, $\rho_0, fromwhichallphysicalscalesemerge.ConclusionDVFTtransformsthePlanckconstantsfrom$ $standingconceptualgapsbetweenquantummechanics, relativity, andcosmology, andpositionsDVFTasc$

43 FUNDAMENTAL AXIOMS AND CONSTANTS

43.1 Core Axioms of the Dynamic Vacuum Field Theory (DVFT)

Axiom 1 — The Vacuum Is a Physical Medium The vacuum is not empty. It is a structured, dynamic vacuum field $\Phi continuumwithanamplitudepandphase\theta undergoesintrinsicDynamicvac$

43.2 Fundamental Constants of DVFT

- Resistance of vacuum phase to spatial distortion. - Fundamental.

- $\rho_0{}^{-} VacuumInertialDensityConstant$ International Journal for Multidisciplinary Research (IJFMR) E-ISSN: 2582-2160 Website: www.ijfmr.com Email: editor@ijfmr.com IJFMR250664112 Volume 7, Issue 6, November-December 2025 97 - Resistance to temporal acceleration of the vacuum phase. - Fundamental.

- Derived from vacuum constants: c = (K / ρ_0).

43.5 Electromagnetic Constants:

$= \rho_0(effective)\mu = 1/K(effective)$

43.6 Gravitational–Vacuum Relation:

G relates $\Phi - drivenenergydensitytocurvature.$

43.7 Mass Generation:

m coupling $\times$ $\Phi Theseshowhowclassicalconstantsemergefromdeepervacuumproperties.Conclusion:$
$DVFTasaFirst-PrinciplesFrameworkDVFTredefinesphysicsfromthegroundupbytreatingthevacu$