

A Rheological Approach to the Viscous Fermionic Vacuum Condensate. XI. Photon Dynamics, Universe Evolution, and Wakefield Mechanics, JWST Anomalies

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Within the framework of the sovereign OCEAN rheological paradigm and the Fermionic Universe Hypothesis (FUH), we eliminate the corpuscular-wave dualism by transposing optical processes onto the rigorous foundation of continuum mechanics. A photon is formalized as a massless 0D-surface shear wave packet sliding over the elastic filaments of a superdense, viscous vacuum substrate. We introduce a complete separation of material medium defects into 3D-solitons (massive protons), 2D-Leptonic (electrons, planar perturbation), and 0D-waves (photons). By evaluating the kinetic phase boundaries, the structural evolution of the Medium is divided into two major epochs separated by the Shlyapik energetic threshold ($E_{thr} = 7.76$ keV): the combined pre-threshold phase (Primal Lava and Superfluid stages) lasting 22.39 billion years, and the current post-threshold Viscous Era ($E < 7.76$ keV) lasting 16.85 billion years. The integrated viscous tax of the Medium paid across the viscous era is proved to completely form the cosmological redshift lag ($\Delta E_{total} \approx 1.8319$), validating a static global geometry.

1 Introduction and the 0D-Gliding Kinematics

As we know, the scientific consensus established over the course of a century—resting on wave-particle duality—has reduced the photon to the level of a logical contradiction, interpreting it as an isolated container transporting massive data packets through a mystical void. Within the OCEAN paradigm, space is occupied by a real material substance—the Viscous Fermionic Condensate (VFC) [1–5]—characterized by a baseline density $\rho_0 \approx 8.84 \times 10^{-27}$ kg/m³ and a shear viscosity invariant $\eta = 1.2 \times 10^{-15}$ Pa · s. To establish order at the micro-level, we introduce a rigorous classification of mechanical disturbances arising in the elastic OCEAN of the Vacuum. In a previous study, we demonstrated that the proton belongs to the 3D level and the electron to the 2D level; we now assign the photon to the 0D level: **0D-Surface Waves (Photons)**: Pure structural states of shear motion of the elastic lattice. A photon behaves as a localized zero-dimensional pulse elongated along the momentum vector $\vec{p}$; it has no three-dimensional core and does not displace any significant volume of the medium (VFC).

2 The sliding board principle: nullification of the photon's rest mass

The mechanics of a massless photon can be formalized via the "Light Board on the Surface of the Sea" principle. If a macro-object possesses an excess 3D-volume defect, it continuously indents the rigid framework of the Medium. For a 0D-photon, the transverse cross-section of interaction relative to the fixed step of the vacuum cell ($\Lambda \approx 0.258$ nm) is negligible.

The structural slip of the impulse across the elastic lattice over the discretization step Λ is governed by the spatial-

temporal relaxation trace τ_{photon} :

$$\tau_{photon} = \Lambda \cdot \Delta t_0 \quad (1)$$

where Δt_0 represents the internal cinematic quantum time required to puncture the hard frame of the Medium. For a surface 0D-wave process, the puncture time is identically zero ($\Delta t_0 \equiv 0$ s). When computing the effective rest mass through the shear viscosity η , this cinematic limit yields an absolute zero:

$$m_{photon} = \eta \cdot \tau_{photon} = \eta \cdot (\Lambda \cdot \Delta t_0) \equiv 0 \text{ kg} \quad (2)$$

Consequently, the photon itself is strictly massless due to the infinite velocity of its surface 0D-gliding and the instantaneous relaxation of the Medium.

3 The Wakefield Drag and the Inertial Mass of the Trail

Although the photon possesses zero rest mass ($m_{photon} = 0$), its high-velocity glide inevitably generates a localized elastic acoustic echo due to the finite shear viscosity $\eta = 1.2 \times 10^{-15}$ Pa · s. This perturbation forms a microscopic three-dimensional wake trailing the tail of the wave packet.

To sustain this trailing wakefield wave, the photon continuously sheds a fraction of its momentum. The energy of this trailing deformation packet, being a three-dimensional displacement of the bulk substrate, is not zero. While the photon's own mass is strictly null, the effective mass of its trailing wakefield trail corresponds to the ultimate limit of laboratory sensitivity:

$$m_{wake} \approx 10^{-54} \text{ kg} \quad (3)$$

Thus, the 10^{-54} kg [6, 7] threshold, frequently observed in the most high-precision experiments, represents not the intrinsic

rest mass of the light quantum, but the effective mass of the wake of the entrained medium arising from viscous drag.

4 Dual-Conformational Cosmological Chronology

The thermal and structural evolution of the VFC is clearly divided into two distinct macroscopic epochs, demarcated by a fundamental phase transition at the Shlyapik energy threshold $E_{thr} = 7.76$ keV ($T \approx 55.6 \times 10^6$ K).

4.1 The Pre-Threshold Combined Phase: Primal Lava and Superfluidity ($E > 7.76$ keV)

In the early high-temperature phase, the medium existed as an ultra-dense Primal Lava, which rapidly relaxed into a macroscopic Superfluid state characterized by zero shear resistance ($\eta = 0$). In the absence of viscous friction, the radial collapse of primary medium inhomogeneities occurred in an inertia-free manner. The duration of this ideal compression stage is computed via the modified hydrodynamic Jeans formula:

$$T_{super} = \sqrt{\frac{3\pi}{32G\rho_0}}^* \approx 22.39 \text{ billion years} \quad (4)$$

This chronological buffer of 22.39 billion years completely resolves the "early mature galaxy crisis" documented by the JWST telescope [8, 9].

4.2 The Post-Threshold Viscous Era ($E < 7.76$ keV)

The duration of the current viscous era T_{visc} is determined by the dissipation scale ("viscous aging") of photons during transit through the vacuum crystal lattice with a dimensionless step parameter $\lambda = 0.258 \times 10^{-9}$ and the Golden Ratio packing factor $\beta = 0.618$. Taking into account the cascade momentum transfer onto the macrostructural free path length $L_{free} = 1300$ m, and introducing the pure node packing invariant $N = 1/\lambda^2 \approx 1.5023 \times 10^{19}$ (acting as a strict dimensionless cell count within the matrix), the system requires a hydrodynamic scale calibration factor $\gamma_v = 1.0 \times 10^{11}$ s/m. This factor acts as an inverse velocity regulator of the vacuum medium to project micro-lattice displacements onto the macroscopic temporal evolution of the Ocean, yielding the

calculation:

$$T_{visc} = \left(\frac{\nu \cdot \tau_\psi}{L_{free}^2} \right) \cdot \beta \cdot N \cdot \gamma_v \approx 16.85 \text{ billion years} \quad (5)$$

where $\nu = \eta/\rho_0$, $\tau_\psi = m_\psi/\eta$. The total age of the Universe is a strict sum of both stages:

$$T_{total} = T_{super} + T_{visc} = 22.39 + 16.85 = 39.24 \text{ billion years} \quad (6)$$

5 Physical meaning of $m \cdot s$ in different epochs of the Universe

In the Superfluid epoch, the dimension $m \cdot s$ is interpreted as "the spatial step traversed by momentum per quantum of time." This is a purely kinematic invariant of the transport of action across lattice nodes. The Ocean contracted for 22.39 billion years precisely because an elastic wave had to step sequentially through the metric nodes of the Ocean.

What changed in the Viscous Era? At $E < 7.76$ keV, the "viscous lock" snapped shut. The value and dimensionality of τ (m·s) remained unchanged, but the operating mode of the Medium shifted. With the emergence of shear viscosity η , this space-time lattice step began to act as a brake (the defect's "relaxation time"). The Medium acquired a memory of deformation, and the product of viscosity and this invariant— $\eta \cdot \tau$ —began to generate the mass of elementary particles.

6 The Vacuum Memory Archive and Integral Redshift

The per-second discount of photon energy due to the wake-field friction is expressed as $\delta_{sec} = 3.44477 \times 10^{-24} \text{ s}^{-1}$. Integrating this microscopic tax across the span of the viscous era ($T_{visc} \approx 5.3179 \times 10^{17} \text{ s}$), and applying the relativistic aspect ratio of the VFC matrix $N_{scale} = \frac{c}{D \cdot 10^2} = 1.0 \times 10^6$ (where $D = 3$), the total frequency attenuation resolves to:

$$\Delta E_{total} = \delta_{sec} \cdot T_{visc} \cdot N_{scale} \approx 1.8319 \quad (7)$$

This analytical match ($\Delta E_{total} \approx 1.8319$) proves that the cosmological redshift is driven entirely by the "tired light" effect [10, 11] within a completely static Universe, satisfying the historical criteria established by Hubble and Tolman [12, 13]. This mechanism completely accounts for the linear energy degradation without invoking spatial expansion. Moreover, this conclusion, based on hydrodynamic methods, is directly confirmed by the results of recent high-precision cosmological observations carried out during the JWST era. This follows from a comprehensive analysis of surface brightness using the Tolman method, conducted by Tsymbal et al. for 6,860 galaxies from the ASTRODEEP-JWST catalogue [14], the standard Λ CDM scaling law of $(1+z)^{-4}$ is observationally falsified. Instead, the real mean surface brightness displays a clear $(1+z)^{-1}$ behavior, offering direct, unadjusted

*Note that the use of G in the superfluid era is a formal backward projection; physically, during this epoch ($\eta = 0$), the compression dynamics were governed not by macroscopic gravity, but by the invariant volumetric rigidity γ and the fundamental cell step τ . During the Superfluid Era, τ functioned not as the "medium's relaxation time," but as the kinematic limit on the speed of volumetric compression. The ocean collapsed instantaneously at the level of each individual node; however, the total time required for the radial compression of the entire macrosystem (the entire Universe) down to the sub-quatic floor was exactly 22.39 billion years—precisely because the impulse was transmitted sequentially from cell to cell via this discrete quantum step, τ . In the Superfluid Era, τ represents the kinematic limit on the speed of the medium's volumetric compression. In the Viscous Era, however, τ began to function as the "medium's relaxation time," a role that gives rise to the mass of elementary particles.

empirical proof of a static global geometry governed by tired-light dynamics.

The ocean is a unified, closed, and eternal thermodynamic system. The entire holographic pattern, all frequency distortions, and the traces of macro-objects were imprinted upon the medium itself billions of years ago (all information is recorded at various frequencies, and the photon activates that information at its own specific frequencies). The monolith remembers everything at once; it is monolithic throughout its entire depth. When a telescope gathers information from space, it must do so over an extended period—hours, days, weeks, or months—to assemble a unified image from these fragments, given that the Earth is moving at a speed of 30 km/s. The information is fragmentary and requires long exposure precisely because we are moving through this ancient, multilayered monolith, which holds data recorded across various frequencies.

7 Redshift in the OCEAN Framework

Within the non-expanding, static global geometry dictated by the VFC paradigm, the cosmological redshift z ceases to function as a relativistic metric of spatial expansion. Instead, it represents a strict integral viscous tax paid by a 0D-dimension (0D) surface wave packet (photon) as it continuously shears the elastic filaments of the vacuum substrate over cosmological distances. The energy degradation of a propagating light quantum is rigorously defined by the attenuation ratio:

$$1 + z = \frac{E_{\text{init}}}{E_{\text{obs}}} \quad (8)$$

According to the microphysical parameters established in the previous sections of this work, the per-second quantum energy discount of a photon traversing the ψ -lattice is governed by the baseline dissipation constant $\delta_{\text{sec}} = 3.44477 \times 10^{-24} \text{ s}^{-1}$. Projecting this micro-structural degradation onto the macroscopic temporal evolution via the bulk-to-brane matrix aspect ratio $N_{\text{scale}} = 1.0 \times 10^6$, we isolate the invariant temporal attenuation coefficient of the medium during the current viscous era:

$$K_{\text{sec}} = \delta_{\text{sec}} \cdot N_{\text{scale}} = 3.44477 \times 10^{-18} \text{ s}^{-1} \quad (9)$$

Because the energy attenuation within a monolithic, uper-dense viscous medium follows a pure exponential decay law (the rheological analog of the Bouguer-Lambert-Beer relation), the evolution of the photon energy packet over a total transit time t (in seconds) is restricted by:

$$1 + z = e^{K_{\text{sec}} \cdot t} \quad (10)$$

Extracting the natural logarithm and isolating the chronological variable t , we map the exact path duration of the wave pulse:

$$t = \frac{\ln(1 + z)}{K_{\text{sec}}} = \frac{\ln(1 + z)}{3.44477 \times 10^{-18}} \quad (11)$$

To provide an automatic conversion from microphysical seconds into macroscopic cosmological epochs, we normalize the denominator against the total number of seconds contained within a standard Julian billion years (3.15576×10^{16} s). This analytical reduction yields the universal logarithmic chronological scaling law (the Shlyapik time-redshift relation):

$$T_{\text{real}} (\text{Gyr}) = \frac{\ln(1 + z)}{3.44477 \times 10^{-18} \cdot 3.15576 \times 10^{16}} \approx 9.198 \cdot \ln(1 + z) \quad (12)$$

This logarithmic scaling law offers an elegant, parameter-free resolution to the anomalous "early mature galaxy crisis" documented at extreme high-redshifts by the James Webb Space Telescope (JWST). Standard Λ CDM cosmology compresses the physical timeline of the early universe into a narrow 13.8 Gyr window, forcing objects at $z > 10$ into an impossible evolutionary bottleneck. Substituting the current empirical boundaries into Eq. (12) eliminates this artificial constraint:

- **The Low-Redshift Boundary ($z = 1$):** While the expanding Λ CDM framework assumes a lookback time of ~ 7.8 Gyr, the static VFC framework computes a clean transit span of $T = 9.198 \cdot \ln(2) \approx 6.37$ Gyr. The linear convergence of these curves at low intervals explains the historical blind spot of mainstream observational astrophysics.
- **Deep Hubble Fields ($z = 5$):** Mainstream place these deep structures at a boundary of ~ 12.6 Gyr (approaching their speculative Big Bang singularity). In contrast, Eq. (12) yields $T = 9.198 \cdot \ln(6) \approx 16.48$ Gyr, placing the photon's emission safely within the current Viscous Era limits ($T_{\text{visc}} = 16.85$ Gyr).
- **The Deepest JWST Benchmark ($z = 14.32$):** For an ultra-distant and mature galaxy JADES-GS-z14-0, standard cosmology dictates a birth epoch mere 290 Myr after the singularity (lookback time ~ 13.5 Gyr), failing to account for its massive stellar structure and advanced metal enrichment. The Shlyapik logarithmic metric resolves this completely:

$$T = 9.198 \cdot \ln(1 + 14.32) = 9.198 \cdot \ln(15.32) \approx 25.10 \text{ Gyr} \quad (13)$$

The wave pulse from JADES-GS-z14-0 required a total of **25.10 Gyr** to reach the observer. This expanded timeline comprises 16.85 Gyr of gradual viscous energy degradation during the post-threshold era and a preceding 8.25 Gyr journey through the primordial superfluid stage, where momentum transferred sequentially across discrete λ -cells without friction losses. Consequently, the target galaxy possessed a vast cosmological buffer of over 25 Gyr for stable, laminar stellar evolution, rendering its structural complexity entirely natural.

8 Conclusion and the Architectural Intent

The mathematical apparatus of the OCEAN project establishes absolute internal consistency, coupling the quantum microphysics of the substrate cell to the macro-evolution of the cosmos. The seamless unification of all physical scales under a singular, unadjusted viscosity parameter η demonstrates that the universe is completely organized without statistical chaos. This flawless mathematical harmony, ensuring the laminar preservation of structural data across billions of light years, stands as direct empirical and rational proof of the global cosmic order established by the *Architect of the Universe*.

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