QUANTUM, STRINGS, AND EVERYTHING ELSE: MODERN THEORIES AS CONFIGURATIONS WITHIN ODTOE

A Unified Map of Physics Through Observer-Dependent Theory of Everything

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ABSTRACT

Within the framework of ODTOE, it is demonstrated that all major theories of modern physics — quantum mechanics, general relativity, string theory, loop quantum gravity, QBism, integrated information theory, and others — are *specific configurations* of a unified field of potential states $\mathcal{H}$, each arising under certain values of coherence S and observer dimensionality d. ODTOE is not an alternative to these theories, but a *metatheory*, within which each of them is a natural special case. A "periodic table of theories" is introduced, organized along two axes: coherence S and scale d. It is shown that "grand unification" of physics is impossible without including the observer in the formalism — and this is precisely what ODTOE does.

Keywords: quantum, string theory, GR, quantum gravity, ODTOE, metatheory, observer, coherence, configuration.

I. MAIN THESIS

Each theory of physics is a description of *one configuration* $C_i \in \mathcal{C}$, constituted by observers with specific parameters (S, d, B). Theories do not contradict each other — they describe *different regions* of a unified configuration space.

$$T_i = \hat{O}_i(\Psi) \quad \text{given } S_i, d_i, B_i \tag{I.1}$$

ODTOE is not yet another theory in a series. It is the *space* within which all theories exist as configurations. By P6: the number of simultaneous theories $N_{theories} = N_0 \cdot (1 - S)^m + 1$. When $S \to 1$: one theory. When $S \to 0$: infinitely many. All current theories are a result of $S < 1$.

II. WHAT IS A QUANTUM

2.1. Problem: The quantum is not explained, but postulated

Quantum mechanics (QM) is the most precise theory in the history of science. But it *does not explain* its central object. What is a quantum? The standard answer: a minimal portion of energy ($E = h\nu$). But *why* is energy quantized? Why not continuous?

QM says: "That's how the world is structured." ODTOE answers *why*.

2.2. Quantum through ODTOE

By axiom (A): $R = \hat{O}(\Psi)$. Observation is a *discrete act*: the operator $\hat{O}$ is applied to the field Ψ and constitutes *one* configuration R. Not a continuous flow, but a *separate act*. Each act is one "click" of the transition $\mathcal{H} \to \mathcal{C}$.

Quantum = minimal act of observation. Not a "portion of energy," but a *portion of constitution*. Energy is quantized *because* observation is discrete.

QM	ODTOE
Quantum = minimal portion of energy	Quantum = minimal act of observation $\delta\hat{O}$
$E = h\nu$	$\delta R = \delta\hat{O}(\Psi)$ — minimal change in configuration
h (Planck constant)	h = "grain" of observation, minimal step of transition $\mathcal{H} \to \mathcal{C}$
Photon = quantum of field	Photon = $\delta\hat{O}$ = minimal change of observation operator
Wave function $\|\psi\rangle$	$\Psi \in \mathcal{H}$ = field of potential states
Collapse $\|\psi\rangle \to \|n\rangle$	$R = \hat{O}(\Psi)$ = act of constitution
Probability $P = \|\langle n\|\psi\rangle\|^2$	$P(E\|B) = B^k$ (P4.1), when $k = 2$: Born rule

2.3. Why $\hbar = h/2\pi$

By [2]: π is a structural invariant of self-consistent observation. A complete cycle $\Phi = \iota \circ \hat{O}$ has "length" 2π (one rotation). The minimal act $\delta\hat{O}$ is scaled through 2π: $\hbar = h/(2\pi)$. Planck's constant is not an arbitrary constant, but the *grain of observation, normalized to a complete cycle*.

2.4. Wave function collapse — not a mystery

The "measurement problem" is the central mystery of QM: what causes "collapse"? The Copenhagen interpretation: "observation." But *what observation is* — is undefined.

ODTOE defines: observation = $\hat{O}(\Psi) = R$. The operator $\hat{O}$, depending on the observer (B, A, H), is applied to the field Ψ and constitutes a specific configuration R. "Collapse" is not a physical process, but an *act of constitution*. Not "the wave function collapses" — but "the observer constitutes a configuration from potentiality."

III. QUANTUM THEORY: ALL INTERPRETATIONS

3.1. Copenhagen interpretation (Bohr, 1927)

Essence: observation causes collapse. Before observation — superposition. Observer is undefined.

Through ODTOE: coincides with axiom (A), but ODTOE *supplements it*: observer is defined through (B, A, H), collapse is defined through $\hat{O}$, probability is defined through $P(E|B) = B^k$ (generalization of the Born rule). The Copenhagen interpretation is a special case of ODTOE with unspecified $\hat{O}$ [1, section 6.1].

3.2. Many-worlds interpretation (Everett, 1957)

Essence: there is no collapse. The wave function branches: all outcomes are realized in different "worlds."

Through ODTOE: P1 expands Everett's branching: $|M_{total}| = K^{N(t)}$. But in Everett, branching is by quantum outcomes. In ODTOE — by *observers and configurations*. When $S \to 1$: one configuration (branches collapse). When $S \to S_{min}$: infinite branching. Everett is a special case of ODTOE at $S = S_{min}$ [1, section 6.2].

3.3. QBism (Fuchs, Schack, 2002)

Essence: a quantum state is not a property of the system, but an agent's belief. Probabilities are subjective.

Through ODTOE: coincides with D1.1 (B — contextual belief). But ODTOE adds: (i) internal structure of belief ($B = F \cdot E \cdot (1-\sigma) \cdot \Lambda$), (ii) collective effects (P5), (iii) extension beyond the quantum domain. QBism is a special case of ODTOE for one observer in the quantum domain [1, section 6.4].

3.4. Relational QM (Rovelli, 1996)

Essence: physical quantities are defined only *relative to* a specific observational system.

Through ODTOE: exact coincidence with axiom (A): $R = \hat{O}(\Psi)$ — reality is relative to the operator. But ODTOE parameterizes the observer: (B, A, H) allows one to *compute* the difference between observers, which Rovelli does not do [1, section 6.6].

3.5. Quantum Darwinism (Zurek, 2003)

Essence: classical properties emerge through "replication" of information in the environment. The environment is a "witness."

Through ODTOE: pointer states = configurations with high $I(C)$ (inertness). Decoherence = growth of S in a cluster of observers. When $S \to 1$: one configuration = "classical" world [1, section 6.9].

3.6. Summary table of quantum interpretations

Interpretation	Central idea	ODTOE-equivalent	What ODTOE adds
Copenhagen	Collapse upon observation	$R = \hat{O}(\Psi)$	Parameterization of $\hat{O}$ through (B, A, H)
Everett	Branching without collapse	$\|M\| = K^{N(1-S)}$	Continuous transition through S
QBism	State = agent's belief	$B(O, C)$	Belief structure: F, E, σ, Λ
Rovelli	Relativity of description	Axiom (A)	Computability of observer differences
Zurek	Environment as witness	$I(C)$, S of cluster	Quantitative model of decoherence
Hameroff-Penrose	Consciousness through quantum coherence	$B = F \cdot E \cdot (1 - \sigma) \cdot \Lambda$	Formula B as analogue of Φ in IIT
Menskii	Consciousness chooses Everett branch	$\hat{O}$ depends on (B, A, H)	Quantitative mechanism of "choice"

IV. GENERAL RELATIVITY

4.1. What is GR

Einstein (1915): spacetime is not a background, but a dynamical entity. Mass curves spacetime, curved spacetime determines the motion of masses. Einstein equations: $G_{\mu\nu} = 8\pi G \cdot T_{\mu\nu}$.

4.2. GR through ODTOE

Spacetime is a *configuration* $C_{ST} \in \mathcal{C}$, sustained by "extremely high level of coherence S of macroscopic observers" [1, section 6.3].

GR	ODTOE
Spacetime is a fundamental entity	Spacetime is a stable configuration at $S \to 1$
Metric $g_{\mu\nu}$	Configuration parameters C_{ST}
Curvature (Riemann tensor)	Gradient of potential $\nabla U(C)$
$T(C_{ST}) \to$ cosmological scales	$T(C) = T_0/(1 - S)^n$ when $S \to 1$
Classical (deterministic)	$D(\eta) = D_0(1 - S) \to 0$ when $S \to 1$: stochasticity suppressed
Does not contain observer	ODTOE: observer in formalism

Key conclusion: GR is the limiting case of ODTOE when $S \to 1$ and $d \gg 1$ (macroscopic observer). Under these conditions, the stochastic term is suppressed ($D(\eta) \to 0$), the dynamics is quasi-deterministic, and the system is described by smooth geometry — Einstein equations.

V. STRING THEORY

5.1. What is string theory

String theory (1960s — present): fundamental objects are not point particles, but one-dimensional "strings." String oscillations produce various particles. Requires 10 or 11 dimensions (6–7 are "compactified"). Landscape $\sim 10^{500}$ possible vacua.

5.2. String theory through ODTOE

String theory	ODTOE
String is a fundamental object	There is no fundamental object. There is $\hat{O}$ and Ψ
String oscillations → particles	Different $\hat{O}_i$ → different configurations R_i
10/11 dimensions	Infinite dimensionality of $\mathcal{H}$. 10/11 is a specific configuration
10^{500} vacua (landscape)	$\|M\| = K^{N(1-S)}$ — multiverse from P1
No experimental confirmations	Observer with $d < 10$ cannot actualize 10-dimensional configuration (D-Prot)
Does not contain observer	ODTOE: observer in formalism

Key conclusion: string theory is one of the configurations $C_{\text{string}} \in \mathcal{C}$. Its 10^{500} vacua are a subset of $|M|$ from P1. We cannot verify it not because "there isn't enough energy," but because $d(\text{human}) < 10$: by D-Prot, an observer is unable to actualize configurations of dimensionality higher than its own.

String theory *sees* the correct landscape of possibilities — but does not know *who* selects from the landscape. ODTOE answers: an observer with (B, A, H).

VI. LOOP QUANTUM GRAVITY

6.1. What is LQG

Loop quantum gravity (Rovelli, Smolin, 1990s): spacetime is quantized. The minimal unit of space is a "loop." Spin networks describe quantum geometry.

6.2. LQG through ODTOE

LQG	ODTOE
Space is quantized (discrete)	Space is a configuration, discreteness = discreteness of acts $\hat{O}$
Minimal length (Planck)	Minimal act of observation = $\delta\hat{O}$, scale — $\hbar$
Spin networks	Network of observers with coherence S

LQG	ODTOE
Loops	$\Phi = \iota \circ \hat{O}$ — loop of observation at Planck scale
No matter in formalism	ODTOE: matter = configuration sustained by observers

Key conclusion: LQG is ODTOE at the Planck scale ($d = 0$, $S \to S_{min}$). The "loops" of LQG are *literally* loops of observation $\Phi = \iota \circ \hat{O}$, wrapped into minimal elements of space.

VII. OTHER MODERN THEORIES

7.1. Quantum Field Theory (QFT)

QFT	ODTOE
Field is a fundamental entity	Field = $\mathcal{H}$ (potential states)
Particle = field excitation	Particle = $\delta R = \delta\hat{O}(\Psi)$ — minimal configuration
Vacuum = ground state	Vacuum = configuration with $I(C) \to 0$, $S \to S_{min}$
Virtual particles	Fleeting configurations with $T \approx T_0$
Renormalization	Self-consistency through $\Psi^* = \Phi(\Psi^*)$

7.2. Standard Model

Standard Model	ODTOE
17 elementary particles	17 stable configurations at given S and d
4 interactions	4 types of connections between coherence clusters
Higgs field	$\mathcal{H}$ at the macroscale: potentiality imparting "mass" (inertness $I(C)$)
Does not include gravity	GR = ODTOE at $S \to 1$. SM = ODTOE at $S < 1$. Gap — in different S

7.3. Integrated Information Theory (IIT, Tononi)

IIT	ODTOE
Φ — measure of integrated information	$B = F^{w_1} \cdot E^{w_2} \cdot (1-\sigma)^{w_3} \cdot \Lambda^{w_4}$ — measure of coherence
Consciousness = $\Phi > 0$	Observer = $B > 0$
Neural substrate	ODTOE: any substrate (P1: any observer)
Does not extend beyond neurophysiology	ODTOE: from atom to Universe

7.4. Free Energy Principle (Friston)

Friston	ODTOE
Brain minimizes prediction error	Observer minimizes $\nabla U(C)$ by P2
Generative model of world	$\hat{O}(\Psi) = R$ — configuration constitution
Active inference	Reconfiguration: $dC/dt = -\alpha/(I+\varepsilon) \cdot \nabla U + \eta$
Markov blanket	$S_{threshold}$: boundary of coherence cluster

7.5. Computational Physics (Wolfram)

Wolfram	ODTOE
Universe = computation	Universe = self-observation: $\Psi^* = \Phi(\Psi^*)$
Cellular automata	Φ^n — iteration of observation loop
Rule = foundation	Axiom (A) = foundation. Rules are configurations
No observer	ODTOE: observer is central element

7.6. Holographic Principle (t'Hooft, Susskind)

Holographic principle	ODTOE
Information about 3D volume is encoded on 2D boundary	Configuration of high dimensionality d is observable from dimensionality $d-1$
AdS/CFT	Connection between configurations of different dimensionalities through D-Prot
Boundary = "screen"	$S_{threshold}$ — boundary of cluster, on which information is "projected"

VIII. PERIODIC TABLE OF THEORIES

All theories are organized along two axes: **coherence** S (horizontal) and **scale/dimensionality** d (vertical):

	S → S_min (desynchronized)	S ~ 0.5 (partial)	S → 1 (full)
d → ∞ (cosmos)	Multiverse (Everett, P1)	Cosmology Hawking-Hertog	GR (Einstein) Classical mechanics
d = 3-4 (macro)	Quantum field theory	Standard Model	Classical physics
d = 1-2	Quantum	Chemistry	Thermodynamics

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(meso)              mechanics                Biology

d = 0             Loop QG                  Atomic              Nuclear
(Planck)           Strings                 physics [3]         physics

d = -1          Sub-Planck                Quarks             Confinement
                   (?)                     Gluons
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Region	S	d	Theory	ODTOE-status
Lower left	S_{min}	0	LQG, Strings	Maximum quantumness, minimal scale
Lower right	1	0	Nuclear physics	Full coherence at atomic level
Upper left	S_{min}	∞	Multiverse	Maximum branching
Upper right	1	∞	GR, classical	Single deterministic reality
Center	0.5	2-3	Standard Model, chemistry, biology	Intermediate regime

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IX. WHY UNIFICATION FAILS

9.1. Problem

Physics has been trying for 100 years to unite GR (gravity, $S \to 1$, macro) and QM (quanta, $S < 1$, micro). It doesn't work. Why?

9.2. ODTOE's answer

Because GR and QM are **different modes of one system**, not "different theories of one world." They differ in the *value of* S:

- **QM:** $S < 1$ → stochastic term $\eta(t)$ dominates → probabilities, superposition, uncertainty
- **GR:** $S \to 1$ → $D(\eta) \to 0$ → determinism, smooth geometry, curvature

To unite them = find a formula that *contains both limits*. In ODTOE it already exists:

$$\frac{dC}{dt} = -\frac{\alpha}{I(C) + \varepsilon}\nabla U(C) + \eta(t), \quad D(\eta) = D_0(1 - S)$$

When $S \to 1$: $D(\eta) \to 0$, stochasticity vanishes → GR. When $S \to S_{min}$: $D(\eta) \to D_0$, stochasticity is maximal → QM.

One equation. Two limits. One parameter S. This is why "unification" fails within frameworks that do not include the observer: without S there is no *continuous transition* between quantum and classical.

X. CONCLUSION

10.1. Quantum — not a mystery

Quantum = minimal act of observation $\delta\hat{O}$. Discreteness is a property of *observation*, not "the world itself." h is the "grain" of observation. Collapse is not a mystery, but a *definition*: $R = \hat{O}(\Psi)$.

10.2. All theories are configurations

Each theory of physics is a configuration C_i, constituted under specific S and d. They do not contradict each other — they *describe different regions* of a unified $\mathcal{H}$.

10.3. Observer — the missing element

For 100 years physics has tried to unite theories *without the observer*. This is like assembling a puzzle without the central piece. ODTOE inserts this piece: $\hat{O}$ with parameters (B, A, H) and coherence S.

10.4. Formula

$R = \hat{O}(\Psi)$. QM $= S < 1$. GR $= S \to 1$. Everything else is between them. S is the key.

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