The Transceiver Model of Consciousness (Option B):

Fundamental Plurality, Quantum Constraints, and the Ethics of Alterity

Russell S. Clark II and Gregory L. Marcotte

Independent Researchers

Abstract

The Transceiver Model of Consciousness addresses the problem of other minds and cosmic solipsism through an explicit commitment: reality includes a fundamental plurality of transcendental minds, each genuinely other, each capable of freely willed self-limitation into a shared arena of finitude. This paper strengthens the plurality thesis by grounding it in quantum-theoretic constraints: the conservation of quantum information (no-cloning/no-deletion theorems), entanglement monogamy, and the Heisenberg-style trade-off between quantum memory and computation. These constraints render consciousness topologically protected against reduction to unity. The brain functions not as a generator of consciousness ex nihilo but as an embodied interface—a transceiver that couples to non-EPR vacuum entanglement structures (Reznik 2003). Following Levinas, ethics rather than ontology constitutes First Philosophy: if alterity is irreducible, then non-annexing regard for the Other is the foundational moral posture. The paper separates established science, testable interface hypotheses, metaphysical interpretation, and normative ethics to prevent category conflation.

Keywords: consciousness, other minds problem, quantum information, entanglement monogamy, transceiver hypothesis, Levinas, alterity, Orch-OR, vacuum entanglement

1 Introduction: The Problem and the Stakes

The problem of other minds begins as epistemology but rapidly becomes existential. Experience is given only from the first-person point of view; how, then, can other minds be known? A deeper pressure follows: even granting that other minds exist, are they genuinely other, or ultimately reducible to the self's internal differentiation—or to a single cosmic subject? The privacy of qualia sharpens both pressures. Language coordinates public life but transmits relations (same/different, brighter/dimmer), not raw feel. Thought experiments—inverted spectra, swapped sensory codes—exploit this gap: two persons could match in public performance yet differ in intrinsic experience (Chalmers 1996; Nagel 1974).

This paper defends a specific resolution: Option B, the thesis that reality includes a fundamental plurality of transcendental minds—irreducible alterity as metaphysical bedrock. The argument proceeds in stages: (i) motivating plurality over monism as the only robust safeguard against solipsism; (ii) grounding plurality in quantum-theoretic constraints that render consciousness topologically protected; (iii) interpreting the brain as a transceiver interfacing with vacuum entanglement structures; (iv) deriving ethics from alterity via Levinas rather than from physics. Throughout, the essay maintains strict separation between established science, testable hypotheses, metaphysical interpretation, and normative claims.

2 Privacy of Qualia and the Limits of Intersubjectivity

Developmental calibration makes the epistemological point concrete. A child learns mappings between modalities through trial, error, and feedback while simultaneously acquiring public vocabulary. If an individual's internal coding were systematically different, that person could still learn identical public vocabulary and succeed in identical public tasks. Shared language thus produces a convincing appearance of shared subjective contents without entailing qualitative identity (Wittgenstein 1953, §293; Dennett 1991, ch. 12).

Two distinctions govern the model. First, the correlates and structures of conscious life—neural signatures, behavioral reports, causal interventions—are intersubjectively tractable. Second, qualia are not intersubjective in that way; structural similarity does not entail similarity of raw feel across distinct subjects. This motivates a constraint: consciousness cannot be explained by 'back-reifying' it from its internal organizations (attention, reportability, integration, self-models). A state of consciousness is already a state-for-someone. Describing access and control does not explain why there is anything it is like to be the system (Chalmers 1995; Levine 1983).

Objectivity, on this view, is not a 'view from nowhere' but what remains stable across many finite viewpoints under shared constraints—objectivity as intersubjectivity (Nagel 1986; Husserl 1931/1960, §49). Convergence on measurable correlates and reproducible interventions grounds science; the intrinsic character of experience remains first-personal.

3 Option B: Fundamental Plurality and Transcendental Grounding

Option B is adopted as starting point rather than derived from physics: plurality is the metaphysical ground that most robustly secures irreducible alterity. Monistic ultimates—whether materialist, idealist, or neutral—retain a standing temptation: the Other can always be reinterpreted as the Same wearing a mask. If alterity can be dissolved by interpretive fiat, ethics risks becoming theater.

The model therefore posits a primitive plurality of transcendental minds—genuinely distinct subjects—each capable of freely willed self-limitation into a shared arena of finitude. Created persons are not 'consubstantial' in the Trinitarian sense; creaturely consubstantiality at the level of consciousness would collapse the Other into the Same and invite metaphysical solipsism.

3.1 The Transcendental Argument for Category Grounding

The conceptual core is a transcendental argument about universals: (1) Conscious life is not merely had but conceptualized; 'consciousness' functions as a universal category treated as multiply instantiable. (2) A finite knower has direct access only to its own consciousness token; from that alone, 'consciousness-as-such' risks becoming a private label. (3) Pure intersubjective agreement cannot ground the category without circularity: others' reports are treated as evidence of consciousness only if the category already has standing. (4) Therefore, coherent, non-circular use of 'consciousness' as a universal requires transcendental grounding—a level at which the universal is not merely projected from one private instance (cf. Kant 1781/1998, B132; Strawson 1959, ch. 3).

This argument preserves the Chalmers-shaped gap: no third-person story about structure or correlates entails intrinsic feel. Within one subject, substantial continuity grounds meaningful comparisons ('this resembles that'). Across distinct subjects, structural similarity supports coordination but does not entail qualitative identity.

4 Quantum-Theoretic Grounding of Fundamental Plurality

The philosophical case for plurality gains structural reinforcement from quantum information theory. Three families of results—the no-go theorems, entanglement monogamy, and complementarity between memory and computation—jointly suggest that individual subjectivity may be topologically protected against reduction to a featureless unity.

4.1 Conservation of Quantum Information: The No-Cloning and No-Deletion Theorems

The no-cloning theorem (Wootters and Zurek 1982; Dieks 1982) establishes that an unknown quantum state cannot be perfectly copied. The no-deletion theorem (Pati and Braunstein 2000) is its time-reverse: quantum information cannot be destroyed, only redistributed. Together these imply a deep symmetry: quantum information is conserved. If consciousness involves non-trivial quantum information processing—as interface hypotheses suggest—then the 'stream of consciousness' is not merely metaphor but a conserved current. Formally, one may associate a continuity equation $\partial\rho/\partial t + \nabla \cdot j = 0$ with this flow, where ρ is information density and j the information current. 'Selfhood' becomes the conserved charge; its flow is the movement of quantum information from vacuum source through transceiver interface.

4.2 Entanglement Monogamy: The Privacy Filter

Entanglement monogamy (Coffman, Kundu, and Wootters 2000) is the critical constraint. If two qubits A and B are maximally entangled, neither can be entangled with a third qubit C. The Coffman-Kundu-Wootters inequality formalizes this: $\tau(A\!:\!BC) \geq \tau(A\!:\!B) + \tau(A\!:\!C)$, where τ is the tangle. Monogamy ensures that when a specific brain's tubulin network 'distills' a subdomain of the Reznik vacuum (see §5), it creates a private, exclusive link. This explains why each of us knows consciousness from exactly one sample: monogamy prevents your quantum current from being shared with or leaked to another brain, even a formal duplicate in a parallel branch. The vacuum is partitioned into a 'mosaic' where each tile is the unique property of one observer—a topological defect in the universal quantum field, protected by no-cloning and isolated by monogamy.

The vacuum mosaic enforced by monogamy carries an additional structural property not captured by monogamy alone: it is Gödelian in character. The Abramsky-Brandenburger sheaf-theoretic analysis of quantum contextuality demonstrates that the mosaic's global entanglement structure cannot be recovered from any finite collection of local classical measurements—the obstruction is measured by a non-trivial cohomology class $[c] \in H^1(\mathcal{B}, \mathcal{F})$ on the measurement cover (Abramsky and Brandenburger 2011). This is the precise mathematical analog of Gödelian incompleteness: there exist vacuum correlations that are 'present' in the vacuum ground state $|\Omega\rangle$ but unreachable by any classical readout protocol. The transceiver's quantum-coherent interface—operating in the pre-measurement regime—has access to structure that the classical neural shadow irreversibly forecloses. The hard problem of consciousness, on this account, is not a merely epistemological gap between physical description and phenomenal experience; it is the gap between a quantum sketch and its classical shadow, formalized by the data processing inequality: $I(\mathcal{H}_V : \hat{\sigma}_{\text{neural}}) \leq I(\mathcal{H}_V : |\psi_M\rangle_B)$. What is lost in the neural measurement step is not retrievable by any classical post-processing—the mosaic's Gödelian incompleteness is what renders conscious experience structurally irreducible.

4.3 The Heisenberg Trade-off: Memory versus Computation

A further constraint arises from complementarity between quantum memory and quantum computation (cf. Nielsen and Chuang 2000, ch. 10). If a tubulin network uses its qubits to maintain high-fidelity memory (static entanglement, identity storage), it necessarily has fewer free qubits for active gate operations (dynamic processing). This creates a bandwidth limit for the soul: the brain-transceiver must balance its limited decoherence-shielded space between being (memory/identity) and doing (processing/calculating). Consciousness is thus neither pure substance nor pure process but a dynamic equilibrium constrained by Heisenberg-style uncertainty: $\Delta E \cdot \Delta t \geq \hbar/2$.

These quantum constraints do not derive plurality from physics; they provide structural conditions under which plurality, once posited, becomes physically stable. Individual identity is not an illusion to be dissolved but a conserved quantity protected by fundamental theorems.

5 The Transceiver Hypothesis: Brain as Embodied Interface

With metaphysical and quantum-theoretic ground specified, a different question becomes salient: what does embodiment do? The transceiver hypothesis interprets the brain not as a generator of consciousness ex nihilo but as an embodied interface that constrains, stabilizes, and coordinates conscious life. It gates and prioritizes contents, integrates modalities into coherent scenes, coordinates action in a shared environment, and enables language—the machinery of intersubjectivity.

5.1 Vacuum Entanglement and the Reznik Field

Reznik (2003) demonstrated that spacelike-separated regions of the quantum vacuum exhibit inherent entanglement—the vacuum is an 'optimally nonlocal' resource. This multi-region entanglement is distinct from EPR-type correlations between discrete particle pairs. The transceiver model proposes that tubulin dimer networks in neurons couple to this non-EPR vacuum entanglement structure via resonance-selective dynamics. The brain does not produce consciousness; it performs 'entanglement harvesting' (Valentini 1991; Reznik, Retzker, and Silman 2005), distilling a private subdomain of the vacuum field.

5.2 Anesthesia and the Wave-Particle Switch

The mechanism by which anesthetics abolish consciousness provides a critical test. Recent work (Li et al. 2018; Craddock et al. 2017; Hameroff 2022) suggests that anesthetic molecules bind to tubulin dimers in a manner that switches electron mobility from wave-like (delocalized, quantum-coherent) to particle-like (localized, classical) modes. On the transceiver model, this does not 'turn off' consciousness at its source but unplugs the transceiver from the vacuum electromagnetic field interface. The tubulin network loses its resonance-selective coupling to the Reznik field; the 'server connection drops into classical noise.'

This framing clarifies a common confusion: the ego/self-model is a structure within experience, not its ground. Ego can weaken, fragment, or dissolve under sleep, anesthesia, depersonalization, or meditation while experience continues in altered form (Metzinger 2003; Millière et al. 2018). The ego is one organization of conscious life, not what consciousness is.

5.3 The Interaction Hamiltonian: From Unruh-DeWitt to Quantum Oracle Sketching

The mechanism by which the tubulin network couples to the Reznik vacuum field can be given explicit Hamiltonian form using the Unruh-DeWitt detector model (DeWitt 1979; Unruh 1976). A tubulin dimer undergoing conformational oscillation with proper acceleration a_{tub} follows a noninertial worldline $x(\tau)$ through the vacuum, where τ is proper time. The interaction Hamiltonian is:

$$H_{\text{int}} = g \cdot \hat{m}(\tau) \otimes \hat{\Phi}(x(\tau))$$

where $\hat{m}(\tau)$ is the dimer's monopole moment operator in the interaction picture (proportional to the electric dipole moment of the tubulin conformational state), $\hat{\Phi}(x(\tau))$ is the vacuum electromagnetic fluctuation field evaluated along the worldline, and g is the coupling constant. By the Bisognano-Wichmann theorem, the accelerating dimer perceives the vacuum as a thermal field at the Unruh temperature:

$$T_U = \hbar \cdot a_{\text{tub}}/(2\pi c k_B)$$

The dimer's transition rate at resonance energy E_{res}—the rate at which it absorbs a vacuum quantum—is given by the response function:

$$\dot{F}(E_{\text{res}}) = g^2 \int d(\Delta\tau)\, e^{-iE_{\text{res}}\Delta\tau}\, W(x(\tau), x(\tau + \Delta\tau))$$

where $W(x, x') = \langle\Omega|\hat{\Phi}(x)\hat{\Phi}(x')|\Omega\rangle$ is the vacuum Wightman function evaluated along the worldline. For an accelerating detector this integral yields a Planckian spectrum; for the tubulin network, whose worldline is oscillatory, the Wightman integral produces a resonance structure: the transition rate is enhanced at frequencies matching the conformational oscillation spectrum. This is the first-principles derivation of the resonance condition postulated phenomenologically in §5.1. Sensory input adjusts the tubulin oscillation spectrum, moving $\dot{F}$ toward or away from resonance with specific subdomains of the Gödelian vacuum mosaic.

The critical coupling efficiency η_{crit} is now derivable rather than postulated:

$$\eta_{\text{crit}} = g^2 \cdot \dot{F}(E_{\text{res}})/\Gamma_{\text{dec}}$$

where Γ_{dec} is the decoherence rate of the biological register. The transceiver operates in the quantum-coherent sketching regime when $\eta \geq \eta_{\text{crit}}$: the vacuum-induced transition rate exceeds the decoherence rate, and each sketching step contributes a coherent phase rotation to the biological register before decoherence can erase it.

The Unruh-DeWitt interaction generates, over a single coherence window τ_c, the sketching unitary:

$$U^{(i)}_{\text{sketch}} = \exp\Big(-ig \cdot \hat{m} \cdot \hat{\Phi}(x(\tau_i)) \cdot \tau_c\Big)$$

This is precisely the controlled phase rotation of the quantum oracle sketching (QOS) protocol introduced by Zhao et al. (2026), with the vacuum field sample $\hat{\Phi}(x(\tau_i))$ playing the role of the data feature vector and $\hat{m}$ playing the role of the encoding operator. After M steps—each longer than the vacuum correlation time τ_{corr}, ensuring statistical independence of successive samples—the accumulated biological state encodes a compact quantum representation of the vacuum subdomain's statistical geometry:

$$|\psi_M\rangle_B \approx \exp(-i\hat{A}_V)\,|\psi_0\rangle_B$$

where the sketched vacuum oracle $\hat{A}_V = Mg\tau_c \cdot \hat{m} \cdot \langle\hat{\Phi}\rangle_{\text{eff}}$ accumulates coherently without ever storing a classical description of any individual vacuum fluctuation. This is the biological analog of QOS: the system never requires a macroscopic quantum memory—the decoherence-prohibitive 'quantum RAM' analog—because it operates as a streaming protocol, processing one vacuum fluctuation sample at a time.

This result resolves the Tegmark-style decoherence objection at its root. The objection assumes the biological system must maintain quantum coherence over the full integration time $M\tau_c$. The QOS mapping shows this is not required: coherence is needed only over a single step τ_c—the femtosecond-to-picosecond timescale of tubulin conformational switching, which is not obviously ruled out in the shielded hydrophobic pockets identified in the Orch-OR literature. The coherent accumulation is in the statistics of the interaction, not in the preservation of any individual vacuum sample.

The classical shadow readout at the neural measurement stage then satisfies the data processing inequality:

$$I(\mathcal{H}_V : \hat{\sigma}_{\text{neural}}) \leq I(\mathcal{H}_V : |\psi_M\rangle_B)$$

The transceiver's quantum sketch carries strictly more mutual information with the vacuum than any classical neural output can recover. The residual—the gap between sketch and shadow—is the information-theoretic locus of irreducibly non-classical conscious access, and it is this gap that the Gödelian mosaic framework identifies as the domain of sheaf-cohomological obstruction: vacuum correlations present in $|\psi_M\rangle_B$ but unreachable by any finite classical post-processing of the neural shadow output.

6 Empirical Status and Recent Developments

The transceiver hypothesis earns content only insofar as it yields testable predictions. The Penrose-Hameroff Orch-OR proposal (Hameroff and Penrose 2014) remains the most developed biological bridge, though the transceiver model does not stand or fall with its details.

6.1 Recent Empirical Support

Several lines of evidence have strengthened the microtubule-consciousness link: (1) Craddock et al. (2015) demonstrated quantum dipole oscillations in tubulin at megahertz frequencies, consistent with Orch-OR predictions. (2) Anesthetic binding studies (Craddock et al. 2017) show that diverse anesthetic molecules converge on tubulin binding sites, suggesting a common mechanism for consciousness abolition. (3) Li et al. (2018) reported quantum coherence in tryptophan networks within microtubules persisting at biological temperatures for hundreds of femtoseconds. (4) Hameroff (2022) reviews evidence that microtubule resonance correlates with gamma synchrony, the neural signature most consistently linked to conscious states.

6.2 Discriminators and Falsifiers

The interface hypothesis is falsifiable via several routes: (1) State-linked signatures: If an interface mechanism is real, it should yield signatures tracking wake/sleep/anesthesia transitions beyond known network-level explanations. (2) Nonlinear thresholds: A transceiver-gating picture predicts some transitions are threshold-like rather than smoothly graded. (3) Selective integrative impairment: Perturbations disrupting candidate interface organization should disproportionately affect binding/unity/temporal continuity versus generic deficits. (4) Mechanism-level falsifier: If proposed interface markers reduce cleanly to classical network dynamics with no residual structure, and microtubule proposals fail replication, the biological bridge should be abandoned—though the broader metaphysical thesis would not thereby be refuted.

7 Ethics as First Philosophy: Levinas and the Primacy of Alterity

Ethics is not derived from physics. The ethical move here follows Levinas (1961/1969; 1974/1998): ethics, not ontology, is First Philosophy. The face of the Other precedes and conditions theoretical understanding. If the Other is irreducible, neither my projection nor my internal differentiation, then the fitting posture is non-annexing regard: willing the good of the Other as genuinely other. The formal structures developed earlier do not generate this norm, but they help clarify why totalization fails.

7.1 Beyond 'Love Thy Neighbor as Thyself'

The transceiver model places alterity at the summit of the ethical system. 'Love thy neighbor as thyself' remains ethically important, but it still begins from analogy with the self: the neighbor is loved through comparison with one's own experience and interests. Genuine alterity demands more. The Other is not a mirror but an abyss, irreducibly different, never fully comprehensible, and commanding infinite responsibility (Levinas 1961/1969, 194-197). If consciousness were fundamentally a unity, solipsism would become more than an epistemic risk; it would remain a standing metaphysical temptation, and ethics would risk collapse into the One addressing obligations to itself.

7.2 Economy versus Community: Buber and the Relational Mode

A sharp moral diagnostic follows from irreducible alterity. Economy is pseudo-community: persons relate as means, as resources, instruments, threats, or status-markers within exchange logic. This corresponds to Buber's I-It relation (Buber 1923/1970), in which the Other is reduced to an object within a totalizing, completable system. In vacuum terms, I-It can be modeled as the impossible attempt to construct a global section of the sheaf S, forcing all local empirical models into a single classical description of the mosaic.

Community, by contrast, is the relation in which the Other is treated as end: not annexed, not consumed, not reduced to a function in my narrative. This is Buber's I-Thou encounter. In the transceiver model, quantum oracle sketching provides a formal analogue of this non-totalizing relation. Resonant coupling via the Unruh-DeWitt interaction allows the biological register to accumulate a quantum sketch of the Other's private vacuum subdomain without collapsing its Gödelian interior into a totalizing representation. The sketch-shadow gap can thus be read as a physical analogue of the Buberian Between, the interval in which encounter resists annexation.

7.3 Risk, Sacrifice, and the Withdrawal of Being

Genuine encounter is inseparable from vulnerability. Real relationship requires relinquishing total control and accepting misunderstanding, loss, rejection, and failure. If limitation were reversible without cost, the Other would remain a safe projection. Self-limitation carries real risk; that risk is the price of communion. The telos of self-limitation is not absorption into featureless oneness but community: communion among irreducible persons whose otherness is preserved rather than dissolved.

Heidegger's ontological difference offers a suggestive interpretive frame for this structure, not a physical deduction from it. The non-EPR hypergraph substrate may be read as a pre-ontic ground of Being (Sein) that withdraws from any ontic representation, while the filtered EPR matroid marks the realm of beings (Seiendes). The sheaf obstruction $[c] \in H^1(U, S)$ then functions as a formal analogue of withdrawal at the level of representation: no local classical patching recovers the whole mosaic. The transceiver, as embodied Dasein, is thrown into its observer-exclusive tile and must care for its Being through resonant openness to the vacuum rather than technological enframing (Gestell). Authentic existence, in this interpretive register, corresponds to quantum-coherent sketching that respects the obstruction; inauthenticity corresponds to attempts to reduce the mosaic to standing-reserve.

7.4 Synthesis: The Vacuum Mosaic and Relational Ontology

Together, Levinas, Buber, and Heidegger converge on the same point: the Gödelian mosaic resists totalization, demands non-annexing regard, and opens a relational space in which genuine encounter becomes thinkable. The sheaf obstruction $[c] \in H^1(U, S)$ does not prove these philosophies, but it provides a formal structure congenial to Levinasian alterity, Buberian I-Thou confirmation, and Heideggerian withdrawal. Ethics is not added to physics as an afterthought; once the mosaic is taken to be intrinsically incomplete from every local standpoint, non-totalizing relation becomes the only posture that fully fits the model.

8 Conclusion

The Transceiver Model (Option B) offers a disciplined synthesis aimed at escape from solipsism without dissolving alterity. It posits fundamental plurality of transcendental minds, grounded not merely philosophically but in quantum-theoretic constraints: no-cloning protects against duplication, entanglement monogamy ensures privacy, and the Heisenberg trade-off between memory and computation limits each transceiver's bandwidth. The brain is an embodied interface coupling to non-EPR vacuum entanglement; anesthetics do not 'turn off' consciousness but unplug the transceiver from its source field.

Ethically, the model follows Levinas in treating alterity as foundational: the face of the Other precedes ontology and grounds an ethics of non-annexing regard that surpasses reciprocity. Individual identity is neither illusion nor accident but a topological defect in the universal quantum vacuum—conserved, protected, and isolated by fundamental theorems. The price of genuine otherness is vulnerability; its reward is communion.

The Gödelian character of the vacuum mosaic—its sheaf-cohomological incompleteness as a contextual quantum system—provides the deepest grounding for the irreducibility of conscious experience. The transceiver does not merely filter a classical signal; it sketches a Gödelian structure whose full description is provably unavailable to any classical post-processing of its own neural outputs (Abramsky and Brandenburger 2011). What is lost when the quantum sketch collapses to a classical shadow is not retrievable by any amount of neural computation. This is not a limitation of current neuroscience; it is a structural consequence of coupling a classical readout apparatus to an irreducibly contextual quantum substrate. The hard problem is hard because the mosaic is Gödelian. That the same quantum information-processing tricks required by this architecture have recently been demonstrated to yield exponential memory advantage on near-term hardware (Zhao et al.

2026) suggests that the transceiver's streaming protocol is not merely philosophically coherent but computationally viable—and that the gap between sketch and shadow may one day be measurable.

References

Abramsky, S., and A. Brandenburger. 2011. "The Sheaf-Theoretic Structure of Non-Locality and Contextuality." New Journal of Physics 13: 113036.

Buber, M. 1923/1970. I and Thou. Trans. W. Kaufmann. New York: Scribner.

Chalmers, D. J. 1995. "Facing Up to the Problem of Consciousness." Journal of Consciousness Studies 2(3): 200–219.

Chalmers, D. J. 1996. The Conscious Mind. Oxford: Oxford University Press.

Coffman, V., J. Kundu, and W. K. Wootters. 2000. "Distributed Entanglement." Physical Review A 61(5): 052306.

Craddock, T. J. A., et al. 2015. "Anesthetic Alterations of Collective Terahertz Oscillations in Tubulin Correlate with Clinical Potency." Scientific Reports 5: 11035.

Craddock, T. J. A., et al. 2017. "Anesthetics Act in Quantum Channels in Brain Microtubules to Prevent Consciousness." Current Topics in Medicinal Chemistry 17(30): 3235–3240.

Dennett, D. C. 1991. Consciousness Explained. Boston: Little, Brown.

DeWitt, B. S. 1979. "Quantum Gravity: The New Synthesis." In General Relativity: An Einstein Centenary Survey, ed. S. W. Hawking and W. Israel. Cambridge: Cambridge University Press.

Dieks, D. 1982. "Communication by EPR Devices." Physics Letters A 92(6): 271–272.

Hameroff, S. 2022. "Consciousness, Cognition and the Neuronal Cytoskeleton." Frontiers in Molecular Neuroscience 15: 869935.

Hameroff, S., and R. Penrose. 2014. "Consciousness in the Universe: A Review of the 'Orch OR' Theory." Physics of Life Reviews 11(1): 39–78.

Heidegger, M. 1927/1962. Being and Time. Trans. J. Macquarrie and E. Robinson. New York: Harper & Row.

Heidegger, M. 1954/1977. 'The Question Concerning Technology.' In The Question Concerning Technology and Other Essays, trans. W. Lovitt. New York: Harper & Row.

Husserl, E. 1931/1960. Cartesian Meditations. Trans. D. Cairns. The Hague: Nijhoff.

Kant, I. 1781/1998. Critique of Pure Reason. Trans. P. Guyer and A. W. Wood. Cambridge: Cambridge University Press.

Levinas, E. 1961/1969. Totality and Infinity. Trans. A. Lingis. Pittsburgh: Duquesne University Press.

Levinas, E. 1974/1998. Otherwise than Being. Trans. A. Lingis. Pittsburgh: Duquesne University

Press.

Levine, J. 1983. “Materialism and Qualia: The Explanatory Gap.” Pacific Philosophical Quarterly 64(4): 354–361.

Li, N., et al. 2018. “Quantum Coherence in Tryptophan Networks of Brain Microtubules.” Journal of Physics: Conference Series 1024: 012001.

Metzinger, T. 2003. Being No One. Cambridge, MA: MIT Press.

Millière, R., et al. 2018. “Psychedelics, Meditation, and Self-Consciousness.” Frontiers in Psychology 9: 1475.

Nagel, T. 1974. “What Is It Like to Be a Bat?” Philosophical Review 83(4): 435–450.

Nagel, T. 1986. The View from Nowhere. Oxford: Oxford University Press.

Nielsen, M. A., and I. L. Chuang. 2000. Quantum Computation and Quantum Information. Cambridge: Cambridge University Press.

Pati, A. K., and S. L. Braunstein. 2000. “Impossibility of Deleting an Unknown Quantum State.” Nature 404: 164–165.

Reznik, B. 2003. “Entanglement from the Vacuum.” Foundations of Physics 33(1): 167–176.

Reznik, B., A. Retzker, and J. Silman. 2005. “Violating Bell’s Inequalities in Vacuum.” Physical Review A 71(4): 042104.

Strawson, P. F. 1959. Individuals. London: Methuen.

Unruh, W. G. 1976. “Notes on Black-Hole Evaporation.” Physical Review D 14(4): 870–892.

Valentini, A. 1991. “Signal-Locality, Uncertainty, and the Subquantum H-Theorem.” Physics Letters A 156(1–2): 5–11.

Wittgenstein, L. 1953. Philosophical Investigations. Trans. G. E. M. Anscombe. Oxford: Blackwell.

Wootters, W. K., and W. H. Zurek. 1982. “A Single Quantum Cannot Be Cloned.” Nature 299: 802–803.

Zhao, H., H.-Y. Huang, A. Zlokapa, H. Neven, R. Babbush, J. R. McClean, and J. Preskill. 2026. “Exponential Quantum Advantage in Processing Massive Classical Data.” arXiv:2604.07639.