Appendice

This Appendix is designed to make Paper A-18 complete and technically usable. It provides a symbol table, derivation sketches for key claims (Born rule emergence and no-signaling), a minimal toy-model calculation, and a glossary mapping standard QM terminology to QIA terminology.

Appendix A. Symbol Table (Variables, Meaning, Units)

Symbol	Meaning	Type / Domain	Unit / Notes
Ψ(x)	Wavefunction / state amplitude in configuration space	Complex function	Normalization per QM
Ψ[U]	CUWF functional state representation	Functional	Depends on field U
ρ	Density operator/state	Operator	Tr(ρ)=1
I[Ψ]	Information functional of state	Scalar functional	Dimensionless or bits (by convention)
S_E	CUWF entropic measure (entropic field entropy)	Scalar functional	Dimensionless / k_B-scaled

$\mathcal{A}$	Routing action / routing cost functional	Functional	Analog of action/cost
$\mathcal{R}$	Routing operator (state update under constraints)	Operator/Map	$\Psi \longrightarrow \Psi'$
κ	Compatibility metric between code/constraints	Scalar/metric	0..1 or real-valued
d_E	Entropic distance between nodes/states	Metric	Dimensionless
$\mathcal{C}$_meas	Measurement constraint injection operator	Constraint set	Depends on apparatus
ε	Phase accessibility threshold parameter	Scalar	Defines classical interface onset
Node	Entropic region/domain unit of network	Conceptual object	Defined via boundary rule

Link	Coupling between nodes	Operator/channel	Can encode capacity
C_E(link)	Entropic channel capacity in QIA	Scalar	Dimensionless / bits
Pointer state	Stable routing attractor state under environment	State subset	Selected by stability
Attractor	Stable routing fixed point/basin in encoding space	Set/region	Minimizes $\mathcal{A}$

Appendix B. Derivation Sketch: Born Rule from Routing Attractor Weights

Goal: show that QIA's routing equilibrium produces outcome probabilities equivalent to the Born rule. We sketch the derivation steps without claiming full rigor (to be completed in future CUWF work).

Step B1: define a set of candidate outcome channels {i} determined by the measurement constraint spectrum $\mathcal{C}$_meas.

Step B2: define routing attractor basins Ω_i in encoding space such that routing dynamics converges to attractor i when initial conditions lie in Ω_i.

Step B3: define an attractor weight W_i as the routing-consistent measure of Ω_i under the state Ψ and compatibility κ.

$$W\_i := \int \_\{\Omega\_i\}\, \mu(\Psi, \kappa, d\_E)\ \ d\Omega$$

Step B4: impose equilibrium selection: probability of outcome i is proportional to its attractor weight.

$$P(i) = W\_i \,/\, \Sigma\_j \, W\_j$$

Step B5: show (or constrain μ) such that W_i ∝ |⟨i|Ψ⟩|². This step becomes possible if μ is derived from conservation + symmetry + stability requirements of routing dynamics.

$$W\_i \propto |\langle i|\Psi\rangle|^2 \Rightarrow P(i) = |\langle i|\Psi\rangle|^2$$

Appendix C. Proof Sketch: No-Signaling under Nonlocal Routing

Consider two nodes A and B with a shared codeword. Measurements correspond to constraint injections $\mathcal{C}$_A and $\mathcal{C}$_B. No-signaling requires that the marginal statistics at A do not depend on the choice of measurement at B.

Step C1: define joint routing update as Ψ ⟶ $\mathcal{R}$(Ψ | $\mathcal{C}$_A, $\mathcal{C}$_B).

Step C2: define local accessible distribution at A by marginalizing over inaccessible degrees of freedom (including hidden routing variables).

$$P\_A(a \mid \mathcal{C}\_A, \mathcal{C}\_B) = \Sigma\_b \, P(a, b \mid \mathcal{C}\_A, \mathcal{C}\_B)$$

Step C3: impose routing consistency constraint that forbids controllable manipulation of shared-code routing variables. Operationally, $\mathcal{C}$_B can change the joint correlation structure but not the marginal at A.

$$P\_A(a \mid \mathcal{C}\_A, \mathcal{C}\_B) = P\_A(a \mid \mathcal{C}\_A) \ (no - signaling)$$

Interpretation: nonlocal routing affects correlation, not local controllable distributions. Thus, QIA allows nonlocal consistency while preserving relativistic signaling locality.

Appendix D. Toy Model Calculation: 2 Nodes / 3 Channels

We define a minimal model with two nodes A,B and three candidate routing channels $i \in \{1,2,3\}$. Let routing action costs be $\mathcal{A}$_i and define attractor weights by an entropic Boltzmann-like form.

$$W\_i \;=\; exp(-\beta\, \mathcal{A}\_i)$$

Then outcome probabilities become:

$$P(i) = W\_i/\Sigma\_j\, W\_j \;=\; exp(-\beta\mathcal{A}\_i)/\Sigma\_j\, exp(-\beta\mathcal{A}\_j)$$

If measurement constraints shift costs (collapse shaping), $\mathcal{A}$_i → $\mathcal{A}$_i + Δ$\mathcal{A}$_i($\mathcal{C}$_meas), then routing selection changes predictably. This toy model demonstrates how discrete outcomes can be viewed as stable channel selection under routing equilibrium.

Appendix E. Glossary: Mapping QM ↔ QIA

QM Term	QIA Interpretation
Wavefunction Ψ	Wave-pattern codeword / distributed encoding
Hilbert space	Encoding space of network codewords
Measurement	Constraint injection + routing stabilization
Collapse	Rapid routing transition to attractor
Born rule	Equilibrium routing probability over attractor weights

Entanglement	Shared code across nodes + routing consistency
Decoherence	Loss of phase accessibility via routing overload
Pointer states	Stable routing attractors under environment
Noise	Routing perturbations / boundary fluctuations
Quantum gate	Controlled routing transformation
QEC stabilizer	Constraint operator shaping routing landscape
Classical world	Coarse-grained interface after phase accessibility loss