
Journal of Natural Science Research and Review

Volume: 02 Issue: 10 October-2026

The Universe as A Relational System: A Novel Quantum–Cosmological Framework From “One Plus One Equals Four” Explaining the Dark Energy Mechanism

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Published Date: October 12, 2026

Article DOI: 10.65150/EP-jnsrr/V2E10/2026-01

ABSTRACT: This paper revises and develops a novel quantum-cosmological conceptual model in which the observable universe is treated as one sector of a broader relational structure. The expression “one plus one equals four” is reformulated not as an arithmetic claim but as a description of how two potentially related spacetime sectors may jointly generate a four-dimensional relational framework. This framework comprises asymmetric spatial contributions from each sector together with a shared temporal dimension and an interface that encodes relational data. Three central concepts are introduced: (i) the corresponding cosmic sector, (ii) black-hole horizons interpreted as possible information boundaries between sectors, and (iii) “folding energy” as a hypothetical effective contribution associated with geometry, topology, compactification, or inter-sector coupling. A preliminary mathematical structure is outlined involving two manifolds, an interface region, a coupling term that respects the asymmetry of the spatial sectors, and an effective action. The framework deliberately distinguishes established physical principles, mathematically admissible constructions, and purely conjectural interpretations. While the model remains speculative, it offers a conceptual bridge that may help orient future investigations into the relationship between quantum theory and gravitation.

KEYWORDS: quantum cosmology, general relativity, black-hole information, spacetime topology, $N+1=4$, vacuum energy, dark energy, extra dimensions, relational universe, theoretical model, Folding Energy.

1. INTRODUCTION

Modern physics rests upon two highly successful yet conceptually distinct frameworks. General relativity describes gravity as the curvature of a four-dimensional spacetime continuum, while quantum mechanics (and its relativistic extension, quantum field theory) describes matter, radiation, and information through quantum states, operators, and probability amplitudes. Each theory has achieved remarkable empirical success within its domain of applicability. Nevertheless, a complete and consistent theory that unifies gravitational dynamics with quantum principles remains an open problem at the foundations of physics.

Numerous approaches have been proposed to address this tension, including string theory and its landscape of compactifications, loop quantum gravity, asymptotic safety, causal dynamical triangulations, and various holographic dualities. In parallel, phenomenological models that introduce hidden sectors, extra dimensions, or dual descriptions have been explored as possible routes toward new physics. The present work does not claim to solve the quantum-gravity problem. Rather, it offers a conceptual reorganization of existing ideas under the unifying motif of a relational universe.

The model developed here, entitled “The Universe as a Relational System,” proposes that the observable universe may constitute one sector of a more extensive physical or mathematical structure. A second sector, termed the corresponding cosmic sector, is postulated. This sector may represent a dual description, a geometrically related branch, a hidden sector, or another component of a higher-dimensional configuration. The novel expression “one plus one equals four” is introduced as a mnemonic and conceptual device: it asserts that the relation between two sectors can generate a four-dimensional framework whose properties are not reducible to either sector considered in isolation.

The paper is organized as follows. Section 3 presents the basic geometric and relational ingredients of the model. Section 4 elaborates the meaning of the expression “one plus one equals four.” Section 5 discusses the corresponding cosmic sector and possible roles for black-hole horizons and folding energy. Section 6 outlines a preliminary mathematical structure. Section 7 examines potential implications. Section 8 concludes.

2. MATERIALS AND METHODS

2.1 Method of the Study

This study is a theory-constrained, observationally anchored conceptual investigation rather than a laboratory experiment. It does not involve human participants, biological materials, physical apparatus, or newly collected experimental measurements. Instead, it evaluates whether a relational two-sector framework can be formulated consistently with established cosmological and astrophysical observations.

The analysis uses a comparative model-building strategy. A standard cosmological model, represented by flat Λ CDM, is treated as the reference model. The proposed relational model is then expressed as an effective extension containing two sectors, an interface, and a possible coupling or

“folding-energy” contribution. The purpose is not to claim that the relational model has already been confirmed, but to identify the future observations that could constrain it.

Although, our concept theory is too new to test, we can develop a trail test, to test whether our hypothesis ($1+1=4$) can be run, in the Planck 2018 observation, which we can calibrate in the (Appendix 1- 6) to identify whether our new concept can be utilized.

3. TWO ASYMMETRIC COSMIC SECTORS

Let the observable sector be represented by a spacetime manifold

$$M_A = (\Sigma_A, g_A, \Phi_A),$$

where Σ_A denotes a spatial hypersurface (or a foliation thereof), g_A is the spacetime metric on the sector, and Φ_A collectively denotes the matter and quantum fields defined on that sector. A corresponding sector can be represented analogously as

$$M_B = (\Sigma_B, g_B, \Phi_B).$$

The two sectors may differ in geometry, matter content, orientation, boundary conditions, or physical state. Their proposed relationship is expressed through a mapping

$$\varphi : M_A \rightarrow M_B$$

(or, more generally, a correspondence that need not be a smooth diffeomorphism). This mapping may encode a symmetry transformation, a duality, a parity or time-reversal operation, a conformal relation, or an informational correspondence between two descriptions of an underlying system. At the present stage these possibilities are treated as interchangeable conceptual options rather than as mutually exclusive alternatives.

The combined configuration may be written schematically as

$$M = M_A \cup_I M_B,$$

where I denotes an interface, boundary, transition surface, or abstract relational structure between the two sectors. This notation does not assert that the sectors necessarily touch in a classical geometric sense; it indicates only that certain information, geometric data, or boundary conditions are related through I .

4. “ONE PLUS ONE EQUALS FOUR”

The expression “one plus one equals four” is deliberately non-standard arithmetic. It is employed here as a conceptual shorthand for three related ideas.

4.1 Dimensional Interpretation

We introduce two spatial sectors are embedded within a common four-dimensional spacetime. Each sector contributes an asymmetric spatial structure; together with a shared temporal dimension they yield a four-dimensional relational framework. The “four” therefore refers to dimensionality rather than to the numerical sum $1 + 1 = 2$.

4.2 Ontological Interpretation

We identify four relational components: sector A, sector B, their interface I , and a higher-level embedding structure in which both sectors reside. In this sense the expression points to an emergent ontology that cannot be reduced to the two sectors taken separately.

4.3 Degrees-of-Freedom Interpretation

We emphasizes that a coupled system generally possesses more degrees of freedom than either component considered in isolation. Two fields may generate interaction terms, collective modes, and boundary degrees of freedom that have no counterpart in the decoupled theory. Schematically one may write

$$S_{total} = S_A[g_A, \Phi_A] + S_B[g_B, \Phi_B] + S_{int}[g_A, g_B, \Phi_A, \Phi_B; I],$$

where S_A and S_B describe the individual sectors and S_{int} encodes their interaction together with boundary or interface data. The interaction term is essential: without it the two sectors remain simply separate systems and the expression “one plus one equals four” loses its intended meaning.

5. CORRESPONDING COSMIC SECTOR, HORIZONS, AND FOLDING ENERGY

5.1 The Corresponding Cosmic Sector

The corresponding cosmic sector is the central speculative postulate of the model. It is introduced as a counterpart to the observable universe that may stand in a dual, geometric, or informational relation to it. Possible concrete realizations include (but are not limited to) a parity-reversed or time-reversed copy, a dual description in the sense of holographic or gauge/gravity dualities, a hidden sector coupled only gravitationally or through higher-dimensional operators, or a geometrically related branch of a multiverse-type construction. At present the model does not select among these possibilities; it merely asserts that the existence of such a counterpart, together with a non-trivial interface, enlarges the conceptual space in which quantum-gravitational questions may be posed.

5.2 Black-Hole Horizons as Possible Information Boundaries

Black-hole event horizons are well-established features of classical and semi-classical gravity. In the present framework they are tentatively reinterpreted as candidate loci at which information belonging to one sector may be related to, or partially screened from, information belonging to the other sector. This suggestion is motivated by existing discussions of black-hole complementarity, the holographic principle, and the black-hole information problem. It remains conjectural: no new dynamical mechanism is derived here that would enforce such a role for horizons.

5.3 Folding Energy

The term “folding energy” is introduced as a placeholder for a hypothetical effective contribution to the total energy-momentum content of the combined system. It is associated with the geometry or topology of the interface, with possible compactification of extra degrees of freedom, or with the coupling between the two sectors. In phenomenological language one may speculate that a positive or negative folding-energy density

could contribute to the observed vacuum energy (dark energy) or to other large-scale gravitational effects. Again, this remains a conjecture; no concrete Lagrangian term is derived in the present work.

6. PRELIMINARY MATHEMATICAL STRUCTURE

Our new mathematical skeleton consistent with the preceding discussion may be summarized as follows.

(i) Two manifolds (or orbifolds, or more general stratified spaces) M_A and M_B , each equipped with a metric and a collection of matter fields.

(ii) An interface region I that may be realized as a common boundary, a thin domain wall, a codimension-one surface, or an abstract correspondence space.

(iii) A coupling term in the effective action that is sensitive to the relative orientation or asymmetry of the spatial structures of the two sectors. Such a term may involve, for example, a relative volume factor, a relative chirality, or a relative orientation of frames.

(iv) An effective action of the schematic form

$$S_{eff} = S_A + S_B + S_I + S_{fold},$$

where S_I collects interface contributions and S_{fold} stands for the hypothetical folding-energy contribution. The detailed field content and the precise form of the coupling remain to be specified in future work. The present paper only asserts that any concrete realization of the relational model must contain structures of this general type if the expression “one plus one equals four” is to acquire a precise dynamical meaning.

7. DISCUSSION: IMPLICATIONS, AND RELATION TO EXISTING APPROACHES

The relational model developed here is intentionally modest in its claims. It does not replace general relativity or quantum field theory; it does not yield new numerical predictions; and it does not resolve the black-hole information paradox or the cosmological constant problem. Its intended contribution is conceptual: it supplies a language in which geometry, information, causality, and inter-sector interaction can be discussed within a single schematic structure.

Several existing research programs share partial overlap with the ideas presented above. Holographic dualities relate gravitational theories in a bulk spacetime to non-gravitational theories on a boundary; braneworld scenarios place our universe on a lower-dimensional brane embedded in a higher-dimensional bulk; and various multiverse or landscape constructions contemplate ensembles of relatively independent sectors. The present framework is compatible with elements of each of these approaches but does not commit to any one of them. Its distinctive emphasis lies on the generative role of the interface and on the claim that the relation itself can enlarge the effective dimensionality or the effective degrees of freedom of the combined system.

Our new concept notions of “corresponding cosmic sector” and “folding energy” are at present placeholders whose physical content must be supplied by future work. Until such content is supplied, the model functions primarily as a heuristic and organizational device rather than as a predictive theory.

Nevertheless, the value of the proposal lies in its attempt to place geometry, information, causality, and interaction within a single conceptual architecture. By representing the two sectors as manifolds connected through a mapping and an interface, the model identifies a possible mathematical language for describing relationships that may extend beyond ordinary spacetime. The interaction action is especially important because it prevents the model from collapsing into a simple collection of disconnected universes. It directs attention toward coupling terms, boundary conditions, information transfer, collective degrees of freedom, and emergent geometric effects. In this limited but precise sense the framework may serve as a starting point for investigating how macroscopic spacetime could arise from deeper relational or quantum principles.

8. CONCLUSION

The $N+1=4$ relational model developed in this paper offers a potentially productive way to reconsider the structure of the universe and the persistent conceptual divide between quantum physics and general relativity. The central proposal is that the observable universe may constitute one sector of a broader system related to a corresponding cosmic sector. Within this setting the expression “one plus one equals four” functions as a conceptual expression of emergence: two distinct but related sectors, together with their interface and a higher-order embedding, may generate a four-dimensional relational framework whose properties cannot be fully understood by considering either sector independently.

The framework remains conjectural and requires substantial further development before it can be confronted with observation or elevated to the status of a dynamical theory. We contribution is a set of interrelated ideas, asymmetric sectors, relational interfaces, horizon boundaries, and folding energy, and the provision of a minimal mathematical skeleton in which those ideas can be expressed. In that capacity the present work aims to serve as a modest but useful conceptual bridge between quantum description and cosmic structure. Hope our new concept approach can bridge up the micro physic and the macro physics, and solves the mystery of the Dark Energy, using the new $N+1$ dimension folding concept, and finally contribute to the world and society.

Acknowledgements

The author thanks the broader theoretical physics community whose foundational work on quantum gravity, holography, and extra-dimensional models has provided the intellectual background for the present conceptual exploration. Any errors or speculative excesses remain the sole responsibility of the author.

Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

REFERENCES

- 1) Einstein, A. (1916). Die Grundlage der allgemeinen Relativitätstheorie. *Annalen der Physik*, 49(7), 769–822.
- 2) Dirac, P. A. M. (1930). *The Principles of Quantum Mechanics*. Oxford University Press.

- 3) Hawking, S. W. (1975). Particle creation by black holes. *Communications in Mathematical Physics*, 43(3), 199–220.
- 4) Bekenstein, J. D. (1973). Black holes and entropy. *Physical Review D*, 7(8), 2333–2346.
- 5) 't Hooft, G. (1993). Dimensional reduction in quantum gravity. *arXiv:gr-qc/9310026*.
- 6) Susskind, L. (1995). The world as a hologram. *Journal of Mathematical Physics*, 36(11), 6377–6396.
- 7) Maldacena, J. (1999). The large-N limit of superconformal field theories and supergravity. *International Journal of Theoretical Physics*, 38(4), 1113–1133.
- 8) Randall, L., & Sundrum, R. (1999). An alternative to compactification. *Physical Review Letters*, 83(23), 4690–4693.
- 9) Arkani-Hamed, N., Dimopoulos, S., & Dvali, G. (1998). The hierarchy problem and new dimensions at a millimeter. *Physics Letters B*, 429(3–4), 263–272.
- 10) Polchinski, J. (1998). *String Theory (Vols. 1–2)*. Cambridge University Press.
- 11) Rovelli, C. (2004). *Quantum Gravity*. Cambridge University Press.
- 12) Ashtekar, A., & Lewandowski, J. (2004). Background independent quantum gravity: A status report. *Classical and Quantum Gravity*, 21(15), R53–R152.
- 13) Weinberg, S. (1989). The cosmological constant problem. *Reviews of Modern Physics*, 61(1), 1–23.
- 14) Padmanabhan, T. (2003). Cosmological constant—the weight of the vacuum. *Physics Reports*, 380(5–6), 235–320.
- 15) Almheiri, A., Marolf, D., Polchinski, J., & Sully, J. (2013). Black holes: Complementarity or firewalls? *Journal of High Energy Physics*, 2013(2), 62.
- 16) Harlow, D. (2016). Jerusalem lectures on black holes and quantum information. *Reviews of Modern Physics*, 88(1), 015002.
- 17) Verlinde, E. (2011). On the origin of gravity and the laws of Newton. *Journal of High Energy Physics*, 2011(4), 29.
- 18) Jacobson, T. (1995). Thermodynamics of spacetime: The Einstein equation of state. *Physical Review Letters*, 75(7), 1260–1263.
- 19) Penrose, R. (2004). *The Road to Reality: A Complete Guide to the Laws of the Universe*. Jonathan Cape.
- 20) Smolin, L. (2001). *Three Roads to Quantum Gravity*. Basic Books.

Appendix 1:

Observational Data Sources

The analysis is based on publicly reported results from the following sources:

Dataset	Observable	Role in the study
Planck 2018	CMB temperature, polarization, lensing, H_0 , Ω_m , σ_8	Baseline cosmological constraints
DESI DR2	BAO distance measurements from more than 14 million galaxies and quasars	Test of the late-time expansion history
Type Ia supernova compilations	Luminosity distance as a function of redshift	Independent expansion-history constraint
LIGO–Virgo–KAGRA catalogues	Gravitational-wave strain and compact-binary parameters	Test of modified propagation or extra-sector effects
Event Horizon Telescope observations	Near-horizon emission and polarization around M87*	Qualitative test of horizon and interface interpretations

Planck data provide the principal reference model because they constrain the basic parameters of the standard cosmological framework with high precision. DESI BAO data are particularly relevant because they measure the expansion history at multiple redshifts and can therefore test whether an additional effective contribution changes over cosmic time.

The gravitational-wave component is included because compact-binary signals provide an independent probe of propagation through spacetime. The LIGO Scientific Collaboration reports continuing releases of gravitational-wave catalogues, including events from successive observing runs. These data could be used to test whether gravitational waves experience attenuation, dispersion, delay, or polarization effects associated with an additional sector.

EHT observations are treated as a complementary qualitative source. They provide information about the environment near the event horizon of M87*. Multi-year observations have shown evolving polarization structures near the black hole.

Appendix 2:

Reference Cosmological Model

The reference model is spatially flat Λ CDM, with the Friedmann equation

$$H^2(z) = H_0^2[\Omega_m(1+z)^3 + \Omega_r(1+z)^4 + \Omega_\Lambda],$$

where:

- $H(z)$ is the Hubble expansion rate at redshift z ;
- H_0 is the present-day Hubble constant;
- Ω_m is the matter-density parameter;
- Ω_r is the radiation-density parameter;

- Ω_Λ is the dark-energy density parameter.

For a spatially flat universe,

$$\Omega_m + \Omega_r + \Omega_\Lambda = 1.$$

The Planck 2018 values used as the principal baseline are

$$H_0 = 67.4 \pm 0.5 \text{ km s}^{-1} \text{ Mpc}^{-1},$$

$$\Omega_m = 0.315 \pm 0.007,$$

&

$$\sigma_8 = 0.811 \pm 0.006.$$

these values are model-dependent because they are inferred within the base- Λ CDM framework. They should therefore be used as reference constraints rather than as model-independent measurement

proposed framework contains two sector:

$$\mathcal{M}_A = (\Sigma_A, g_A, \Phi_A),$$

$$\mathcal{M}_B = (\Sigma_B, g_B, \Phi_B),$$

Here, Σ_A and Σ_B are spatial hypersurfaces, g_A and g_B are metric fields, and Φ_A and Φ_B represent matter and quantum field, interface I is introduced to represent a boundary, correspondence space, domain wall, or nonlocal relational structure

$$\mathcal{M} = \mathcal{M}_A \cup_I \mathcal{M}_B.$$

effective action is written as

$$S_{\text{eff}} = S_A + S_B + S_I + S_{\text{coup}} + S_{\text{fold}},$$

where:

- S_A describes the observable sector;
- S_B describes the corresponding sector;
- S_I describes interface or boundary contributions;
- S_{coup} describes interactions between sectors;
- S_{fold} represents the proposed folding-energy contribution.

$$\rho_{\text{fold}}(z) = \rho_{\text{fold},0} f(z),$$

Min: Folding Energy, with max corresponding N+1 Dimension, Max: Folding Energy, with min corresponding N+1 Dimension. Where $\rho_{\text{fold},0}$ is the present-day effective energy density and $f(z)$ describes its redshift evolution.

Appendix 3:

Constant folding energy

$$f(z) = 1.$$

mathematically equivalent to an additional cosmological-constant-like contribution

Matter-like folding energy

$$f(z) = (1 + z)^3.$$

Radiation-like folding energy

$$f(z) = (1 + z)^4.$$

would be strongly constrained by early-universe observations.

Dynamical dark-energy form

$$f(z) = (1 + z)^{3(1+w_{\text{fold}})},$$

w_{fold} is an effective equation-of-state parameter.

Under this parameterization, the expansion equation become:

$$H^2(z) = H_0^2[\Omega_m(1 + z)^3 + \Omega_r(1 + z)^4 + \Omega_\Lambda + \Omega_{\text{fold}}f(z)].$$

The parameter Ω_{fold} is not assumed to be non-zero. It is estimated as a free parameter, and the standard Λ CDM model corresponds to

$$\Omega_{\text{fold}} = 0.$$

formulation transforms “folding energy” from a purely verbal concept into a hypothesis that can be constrained by observational data
Coupling Parameter

The interaction between sectors may be represented phenomenologically by a dimensionless parameter ϵ :

$$S_{\text{coup}} = \epsilon \int d^3x \sqrt{|h|} \mathcal{O}_A \mathcal{O}_B,$$

where,

- h is the induced metric on the interface;
- $\mathcal{O}_A$ is an observable or field operator in sector A ;
- $\mathcal{O}_B$ is the corresponding operator in sector B ;
- ϵ controls the strength of the coupling.

Null compiling limit:

$$\epsilon = 0.$$

If $\epsilon = 0$, the two sectors are dynamically independent. A non-zero value would imply that the sectors can influence one another through the interface.

Because no established theory currently determines the exact form of $\mathcal{O}_A \mathcal{O}_B$, the coupling is treated as an effective parameter rather than as a derived fundamental interaction

Testable Predictions

Relational framework generates several possible observational sign such as:

Expansion-history deviation

non-zero Ω_{fold} could alter the redshift dependence of $H(z)$, the comoving distance $D_M(z)$, and the luminosity distance $D_L(z)$:

$$D_M(z) = c \int_0^z \frac{dz'}{H(z')},$$

$$D_L(z) = (1+z)D_M(z).$$

Quantities can be compared with BAO and Type Ia supernova observation

Appendix 4:

Gravitational-wave propagation

coupling to a corresponding sector could produce a modified gravitational-wave propagation equation:

$$\ddot{h}_{ij} + [3H(z) + \Gamma_{\text{eff}}(z)]\dot{h}_{ij} + \left[\frac{k^2 c^2}{a^2} + \mu_{\text{eff}}^2(z)\right]h_{ij} = 0,$$

where:

- Γ_{eff} represents additional damping;
- μ_{eff} represents an effective mass or dispersion term;
- h_{ij} is the gravitational-wave perturbation.

Standard general-relativistic limit is

$$\Gamma_{\text{eff}} = 0, \mu_{\text{eff}} = 0.$$

deviation would need to be constrained using gravitational-wave observations

Appendix 5:

Black-hole ringdown:

the interface is associated with horizon-scale physics, it may modify the quasi-normal-mode frequencies of black holes:

$$\omega_n = \omega_n^{\text{GR}} + \delta\omega_n,$$

$\delta\omega_n$ represents a possible relational correction. The model is viable only if $\delta\omega_n$ remains compatible with observed gravitational-wave ringdowns.

Horizon-scale polarization

framework may also be compared with EHT polarization observations. However, such observations should be used only to assess whether the model is compatible with near-horizon magnetic-field structures. They should not be interpreted as direct evidence for an interface with another

universe or sector. The EHT has observed changing polarization patterns around M87*, but conventional plasma and magnetic-field models remain relevant explanation.

A quantitative implementation, the model parameters may be estimated using a likelihood function;

$$\mathcal{L}(\boldsymbol{\theta}) = \mathcal{L}_{\text{CMB}} \mathcal{L}_{\text{BAO}} \mathcal{L}_{\text{SN}} \mathcal{L}_{\text{GW}},$$

where

$$\boldsymbol{\theta} = (H_0, \Omega_m, \Omega_{\text{fold}}, w_{\text{fold}}, \epsilon).$$

the corresponding log-likelihood is

$$\ln \mathcal{L} = \ln \mathcal{L}_{\text{CMB}} + \ln \mathcal{L}_{\text{BAO}} + \ln \mathcal{L}_{\text{SN}} + \ln \mathcal{L}_{\text{GW}}.$$

relational model should be compared with Λ CDM using information criteria

$$\text{AIC} = 2k - 2\ln \mathcal{L}_{\text{max}},$$

&

$$\text{BIC} = k\ln(n) - 2\ln \mathcal{L}_{\text{max}},$$

where: k is the number of free parameters; n is the number of observation

$\mathcal{L}_{\text{max}}$ is the maximum likelihood

more complex relational model should not be regarded as supported merely because it can fit the data better. Its improvement in fit must be sufficient to justify the additional parameters

Appendix 6:

Trail test & Falsifiability Criteria

model would be weakened or reject if:

- Ω_{fold} is consistently constrained to zero;
- the inferred coupling parameter satisfies $\epsilon \approx 0$ across independent datasets;
- no deviations from standard gravitational-wave propagation are found;
- the model requires parameter values incompatible with CMB, BAO, supernova, or gravitational-wave observations;
- the proposed interface produces instabilities, violations of causality, or unacceptable energy conditions;
- the model cannot be expressed through a well-defined action and field equations.

Conversely, support for the model would require a statistically significant, independently replicated deviation from Λ CDM or general relativity that is naturally explained by the same coupling parameters across multiple observations

Reproducibility

A complete empirical version of this study should provide:

- the exact Planck likelihood version;
- the DESI BAO data release and covariance matrix;
- the supernova catalogue used;
- the gravitational-wave events and posterior samples;
- parameter priors;
- sampling software and convergence criteria;
- the full likelihood function;
- code for reproducing all tables and figures.

Preliminary Mathematical Structure, the mathematical skeleton consistent with the preceding discussion may be summarized as follow. Two manifolds (or orbifolds, or more general stratified spaces) $\mathcal{M}_A$ and $\mathcal{M}_B$, each equipped with a metric and a collection of matter field. Interface region I that may be realized as a common boundary, a thin domain wall, a codimension-one surface, or an abstract correspondence space. Coupling term in the effective action that is sensitive to the relative orientation or asymmetry of the spatial structures of the two sectors. Such a term may involve, for example, a relative volume factor, a relative chirality, or a relative orientation of frames. effective action of the schematic form:

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