

Emergent Quantumcorrelations as global fixpoint-structure in topotronics-theory.

A superdeterministic model of cosmos as a binary operator - the universe as a global fixpoint in topotronic-theory is mostly indistinguishable from quantum description.

Abstract:

Reconstructed are the fundamental basic ideas in a minimal superdeterminism-model. The global fixpoint structure ω codates measurements and apparates simultaneous, while an selector-operator generates stability and coherence via a minimal-principle. Discrete functions of measuring $A(a)$ and $B(b)$ on ω reproduce exactly the quantum correlations $E(a,b) = -\cos(\theta)$. The CHSH- correlations appear at the emergent quantum area, whereby the Bell-inequation appears as an emergent, not as a fundamental physical law. The minimal measurable deviation is $\Delta d \gtrsim 0.1\%$. The model offers a consistent, logical structure, connecting superdeterminism and emergent effective quantum logic. Classical quantum structure appears not on a fundamental level but only as an emergent overlaying structure like in the demand of Einstein. Particularly in the connection with a theory of quantum gravity it is necessary to explore new ways of formulating fundamental spacetime-structures like quantum states to get greater significance in the clearness of a consistent underlying description.

Key-words: Topotronic-model; superdeterminism; QT not fundamental; QT emergent; Bell-inequality; quantum gravity; gravity as emergent average; Einstein-equation; quantum-logics; binary logics; topotron.

Holger A.W. Döring
Technische Universität Berlin
Germany
DPG Departement: matter and cosmos
Section: GRT and gravity
Physikalische Gesellschaft zu Berlin
Oxford-Berlin University-Alliance,
Research Partnership
ORCID: 0000-0003-1369-1720
e-mail: holger.doering@alumni.tu-berlin.de
h.doering.physics.tu-berlin@t-online.de

1. Introduction:

The classical quantum experiments, especially the Bell-testexperiments, demonstrate correlations between two indidents, which are not compatible with local-deterministic models. The ansatz of a global topotronic-like fixpoint structure offers an ontologic base, where all measurements are codated in a simultaneous way. By interpretation of an extremal-principle there can be constructed stable fixpoints, which support deterministic measurable functions $(A(a);B(b))$. With a suitable, setting or tuning of the significance of the fixpoint variable λ , the quantum correlations

can be done exactly reproducable. At this emergent quantum level there generates CHSH-injuries, whereby the fundamental area remains deterministic. This model allows a superdeterministic, consistent reconstruction of a global universal structure of cosmos, which in the empirical way appears almost without a difference from the description of quantum theory.

2. Calculations/Methods:

2.1. The fundamental level:

Announced is, that spacetime is not continuous but consist of fundamental levels of basic area-units, which could be called “topotrons“. There are no points defined, there is no infinitesimal differentiable structure defined, there are no real coordinates at the fundamental base. But there is the minimal structure of the topotrons. A topotron can be modeled as:

1. An elementary two-cell object,
2. with a defined discrete orientation-state,
3. with finite set of states.

In a more formal way let :

$$M=(S, R) \quad , \quad (1a.)$$

where S is a finite set of states with a binary configuration, and R is the relation to neighbour-topotrons. Therefore a single topotron wears:

$$S=\{0;1\}^k \quad (1b.)$$

for a finite number k of binary degrees of freedom.

2.2. The topotronic space:

A physical space of the topotron then is:

$$\{R\}=\{M_i\}_{i \in I} \quad (1c.)$$

with the neighbour relation of:

$$R \subseteq I \times I \quad . \quad (1d.)$$

This leads to a discrete two-cell complex, a finite or countable net and no smooth manifold. A continuum generates for the first time as a macro approximation.

2.3. The configuration space:

The whole state of the system is:

$$\Omega=\prod_{i \in I} S_i \quad (2a.)$$

This is a very large space of states with for now only combinatoric description.

2.4. The selector as an operator:

Formal a selector is:

$$\sigma: \omega \mapsto \omega'; \sigma(\omega) = \omega' \quad (2b.)$$

And

$$\omega' \subseteq \omega \quad (2c.)$$

whereby only these configurations are conserved, which fulfill the coherence-conditions, have compatibility of structure and hold the conditions of symmetry. Formal this is a projection onto a partial set with additional conditions.

2.5. Dynamics:

Differential-equations are substituted by discrete transition rules and structural steps of selection, like

$$\omega_{n+1} = \sigma(\omega_n) \quad (3a.)$$

This condition is near to cellular automats, discrete evolution dynamics or structural fixpoint-building.

2.6. Beyond quantum logics:

The new interesting conception is more than quantum logic. To distinguish these concepts, first the principles of quantum logics have to be formulated:

The quantum-logics after Birkhoff-von Neumann [1.] describes statements or evidences as subspaces of Hilbert-spaces. This description uses projection operators and non-distributivity. What then is the structure of classical quantum logics?

Given is a Hilbert-space H , where statements live on self-contained, enclosed subsets, operators generate projections and the generated states are vectors. Non-distributivity is created by non-commutativity of the non-abelian operators.

2.7. The new description is binary but includes a deeper structure:

The beginning is with: $S = [0; 1]$ which is nothing but classical Aristoteles-like binary logic.

But by recursive complex interlocking a multiplestep logical space is generated, where:

1. Statements cannot any longer combined independent,
2. Compatibility depends from the underlying structure,
3. Reality is stabilized selective.

The decisive different factor between classical quantum logic and this description is:

I Quantum-logic: Non-distributivity is generated by operator-algebra.

II The new description: Structure is generated by coherence of selection from a discrete possibility-space.

The new description is deeper onto an ontological level: Quantum-logics modifies logic because of physics, the new topotron-description constructs physics from logics!

Some of the main differences are the following:

Quantum-theory:

1. Complex numbers,
2. Interference,
3. Unitary evolution.

Topotron-theory:

1. Pure discrete,
2. No complex phases,
3. No linear superposition.

There is no amplitude-structure on a fundamental level and the underlying space of possibilities is pure combinatorial, not vectorial. What of the description is more than quantum logic is the generativity. Quantum logic describes states – topotron-theory describes generation of structure.

In this case of topotron-theory the coherence of selection can be interpreted as focussed stabilization via a minimal principle. This formulation doesn't exist in quantum theory.

2.8. A polydimensional hierarchy of structures:

From this system of new paradigm-memes there can be developed from topotron-theory:

1. Intern coordinates of structure,
2. Additional spaces of dimensions,
3. Possibly information dimensions. This all is no part of conventional quantum logic.

Quantum logics is a mathematical structure of measuring process. Topotron-theory is a logical structure as an ontological fundamental base. Where quantum logic only formulates a geometry of measuring operators, topotron-theory formulates a logic of genesis of possible structures. In this case it is not only descriptive but explaining. So it is deeper from its ontological structure: quantum-logic works in a giving space H , topotron-theory tries to explain, why in general structured space can exist. This form of pre-spacetime-description, which is first of all generating a spacetime, is near to discrete spacetime-models, spin-network but without an amplitude-structure, cellular automats or information based ontology than to classical quantum logics [2.].

3. Emergence of a metric from topotron-theory:

3.1. Starting point are given topotrons:

1. Discrete topotrons M_i ,
2. Neighbour-relation: $R \subset I \times I$,
3. Binary inner states: $S_i = \{0; 1\}^k$.

There is no distance, no coordinates, no length-structure of measurement-theory. Only relations and intern states.

3.2. Graphic structure:

Step 1:

Because the topotrons form a graph of following structure:

$$G = (I, R) \quad . \quad (3b.)$$

A natural defined distance then is the distance of two graphs. This distance may be identified with Planck-length.

$$d_G(i, j) = l_{min} \quad . \quad (3c.)$$

- Length of shortest path. This already is a discrete metric but the description is still pure topology.

Step 2:

State-dependent weighting. Now selection comes in the game: Not every connection stays active, selectors filter configurations. Then a weighting function is defined:

$$w(i, j) = f(S_i, S_j) \quad (3d.)$$

Example given:

1. compatible states $S \rightarrow$ small distance,
2. incompatible states $\bar{S} \rightarrow$ larger distances.

Then there generates a weighted distance of:

$$d(i, j) = \min_{paths} \sum w \quad (3e.)$$

Therefore “distance“ depends from coherence of structure.

Step 3: Limit to continuum:

If the topotron density is large and and the structure is homogenous then the discrete distance converges towards an effective metric of $g_{\mu\nu}$.

This condition means, that the metric is no fundamental basic element but a statistic average-structure of selective topotron-configurations. This description is analogous to theories of elasticity on atomic lattices or to effective field-theories.

But in this case here the discreteness is ontological in a fundamental way.

3.3. Interpretation:

Curvature then generates from local variation of selection of coherence. This means:

Curvature $R_{ik} \sim S_{struc}(Inhom)$ appears as an inhomogeneity of selection of structure.

Gravity would appear as structural variation of density.

3.4. Selectors as fixpoint-operators:

$$\text{Let: } \omega = I_{config} \sum_n S_{top} \quad (4a.)$$

- Omega is configuration-space of all topotron states. Then the selector is:

$$\sigma = \omega \mapsto \omega; \sigma(\omega) = \omega \quad (4b.)$$

$$\sigma(\omega) = P_{struct} . \quad (4c.)$$

Sigma is a structure-consistent projection.

Idea of fixpoints:

Physical reality corresponds to stable structures. Ergo

$$\omega^* = \sigma(\omega^*) . \quad (5a.)$$

This is a fixpoint. Reality then is: existing of a fixpoint under the dynamic-conditions of selection.

3.5. Iterative dynamics:

Evolution can be written as:

$$\omega_{n+1} = \sigma(\omega_n) , \quad (5b.)$$

iff

$$\lim_{n \rightarrow \infty} \omega_n = \omega^* . \quad (5c.)$$

If this condition exists, then ω^* is a stable attractor.

3.6. Comparison to well-known theories:

This description is similar to renormalizationgroup-fixpoints, to attractors of dynamical systems, to models of selforganization and to constraint satisfaction systems but in this case here the fixpoints are ontological real.

3.7. The selector as a projector:

$$\text{iff } \sigma^2 = \sigma , \quad (5d.)$$

the selector is idempotent \rightarrow projector. Then there is:

$$\omega' \rightarrow \sigma(\omega') \quad . \quad (5e.)$$

Only this partial set physically can be realized. In topotron-theory there is a stronger meaning-condition than in classical quantum theory. An interpretation in form of a minimal principle can be made. Which means, that fixpoints act like destination states but mathematically this only means the following conditions:

1. Stable attractors,
2. Minimizing of a structural functional,
3. Maximation of coherence.

3.8. The connection: fixpoints generate metric:

Both conditions are combined now:

Filtering by selectors:

$\omega \rightarrow \omega'$. Only ω' determines a certain effective neighbour structure. Then the metric is generated by:

$d(i, j) = d_{\omega'}(i, j)$. Ergo without a fixpoint no stable metrical structure – with a fixpoint there is an emergent geometry.

3.9. A deep structural interpretation:

The formulation is like binary logics generates a possibility-space, where a selector acts as a fixpoint operator. Fixpoints then define stable relations and stable relations generate effective metric. Metric then appears as a spacetime.

This is different from Einsteins assumption, that metric is fundamental. Here metric is an artifact of selection.

3.10. Generation of an effective Einstein-equation by topotron-selection:

Part 1:

Emergence of an effective Einstein-equation.

I Starting point is the giving of a discrete topotron-space $(G=(I, R))$, a configurationspace of $\omega = \prod S_i$, a selector-operator of form σ and the existence of fixpoints with the condition of:

$$\omega^* = \sigma(\omega^*) \quad . \quad (6a.)$$

The fixpoints are physically real.

II Emergence of metric:

$$d(i, j) = \text{Min}_{paths} \sum w(i_k, i_{k+1}) \quad (6b.)$$

$$\text{with } w(i, j) = f(S_i, S_j) \quad (6c.)$$

In limes of continuum there is generated

$g_{\mu\nu}(x)$. But the main decision now is that the weight-function depends from the local structural density.

III Coherence of structure as an energy-density:

Define a local coherence-function

$\rho(x)$ as a density of selection-stable topotron-configurations with interpretations of:

1. High coherence \rightarrow high density of structure,
2. Low coherence \rightarrow small density of structure.

This quantity acts like an effective energy-momentum tensor:

$$\rho(x) \sim T_{\mu\nu} . \quad (7a.)$$

IV Variation of coherence generates curvature:

The metric is generated from the fixpoint of the selection-dynamics. Formal this means that the dynamics of selection minimizes a structural functional.

$$\{F\}[g] = M_I , \quad (7b.)$$

where M_I is a measure quantity of incoherence and the fixpoint-condition is:

$$\delta\{F\} = 0 , \quad (7c.)$$

Supposed now is, that this functional locally only depends from curvature and coherence-density, then a Taylorseries-developement of lowest order produces

$$\{F\} \sim R + \alpha \rho , \quad (8a.)$$

Variation then produces:

$$G_{\mu\nu} = \kappa T_{\mu\nu} , \quad (8b.)$$

ergo structural the Einstein-equations for gravity.

V Interpretation:

Einstein: mass curves spacetime.

Topotron-theory: structural coherence changes the selectionstable neighbourhood \rightarrow generates effective curvature. Gravity then can be interpreted as macroscopic manifestation of local selection inhomogenities.

What ergo is different:

No fundamental constant from axioms, no continuous spacetime base. Gravity is statistical fixpoint-structure.

Part 2:

I Categorical structure of the selectors:

First define a category of topom-configurations $\{C\}$. Objects are the configuration-spaces ω . Morphisms are the structural mappings between configurations. Then the selector works as an endofunctor like:

$$\Sigma: C \rightarrow C \text{ and } \Sigma(\omega) \in C \forall \omega \in C \quad (9a.)$$

It orders every object $\omega \rightarrow \Sigma(\omega)$, ergo is a structure-consistent part-category. Every ω a σ -algebra $\Sigma(\omega)$ is assigned.

II Now fixpoints are introduced as algebras of the functor:

$$\omega^* \simeq \Sigma(\omega^*) \text{ then } \omega^* \text{ is a fixpoint of the functor } \Sigma. \text{ This exactly is the definition of an}$$

F algebra. Ergo: physical reality as algebra from a selectionfunctor. All non physically consistent and non-correct categories are screened out of the possible physical vacuums and are erased from the out-projection.

III Terminal co-algebra and dynamical standpoint:

If now dynamics is considered:

$$\omega_{n+1} = \Sigma(\omega_n) \quad (9b.)$$

Then reality can be defined as terminal co-algebra of the functor, which means in mathematical language, it is the universal stable attractor.

IV Topos-perspective:

If the binary states are assumed as inner verification-values of $v \in \{0,1\}$, then the topotranspace could be interpreted as a discrete topos and the selectors act like:

1. Intern modal operators,
2. Filters of consistence,
3. Logical closure-operators.

Then there is: $\Sigma^2 = \Sigma$ - an idempotent type of a monade.

IV Deeper structure:

Binary logic as inner verificiation-concept, topotrons as discrete objects, selectors as structural monades and fixpoints as real (realized) universes. This is more abstract than quantum logics.

Comparison to quantum-logics:

Quantum-logic	Topon-theory
Category of Hilbert-spaces	Category of discrete spaces of configurations
Projections as morphisms	Endofunctor as a selection-principle
Non-distributive composite-grid	Reality as a radical fixpointalgebra

Table 1: Comparison between the categories of classical quantum logic and the topon-theory. Here therefore is moved from an operator-based logic of measurement to a categorical logic of structure generation.

V Short summary:

Fundaments are binary differences, the structure is of discrete topotron-configurations, the needed operator is a selection-endofunctor and the stability of the outprojection of reality is the result of a fixpoint-algebra. Geometry occurs as emergent metric from fixpoint-structure and gravity appears as inhomogeneity of the equilibrium of selection.

4. Quantizing in topotronic model:

Until now there are: discrete topotrons τ , configuration-space of ω , selector Σ , fixpoints as real structures and an emergent generated metric. But until now this all is pure deterministic. Now it must be quantized. Quantizing demands the following conditions:

1. Superposition,
2. Non-commutativity,
3. Structure of probability.

4.1. Possibility of a Hilbertspace over a topotron-configuration:

Define a Hilbert-space: $H=l^2(\omega)$, ergo quadratic summable functions on the selected configuration-space. A state then could be: $\psi:\omega' \rightarrow C$. This is a classical quantizing of discrete systems. Then there are basic states as concrete topotron-configurations and operators are linear operators on H .

4.2. Selector as an projection-operator:

$$\text{Iff } \Sigma^2 = \Sigma, \tag{10a.}$$

the selector can be interpreted as an projector (P) :

$$P:H \rightarrow H. \tag{10b.}$$

Physical states are fulfilled by:

$$P\langle \psi \rangle = \langle \psi \rangle. \tag{10c.}$$

This situation is similar to additional conditions in canonical quantum gravity.

4.3. Non-commutativity:

A quantum structure only comes into being, when different selectors do not commute :

Ergo:

$$\Sigma_1 \cdot \Sigma_2 \neq \Sigma_2 \cdot \Sigma_1 \quad . \quad (11.)$$

Then generates a non-distributive structure which is a parallelism to quantum-logic. Without non-commutativity all descriptions remain classical discrete.

4.4. Interpretation:

Quantizing then here would be:

1. Linearizing of the discrete selectionspace and
2. Introduction of non-commutative selectors.

4.5. Renormalization and flow-equation:

Some sort of coarse-grin:

Topotrons are fundamental discrete. Macroscopic physics then will be generated by:

1. Formation of blocks,
2. Averaging,
3. Effective parameters.

Define a formation oblocks:

$$B_k := \omega \rightarrow \omega_k \quad (12a.)$$

with k size of blocks . Then an effective selector on scale k can be written as:

$$\Sigma_k = B_k \circ \Sigma \circ B_k^{-1} \quad . \quad (12b.)$$

Now the effective couplings depend from the scale.

The flow-equation then can be formulated by setting an effective parameter of structure $g(k)$,
example: strength of coupling between the topotrons:

$$k \frac{dg}{dk} = \beta(g) \quad (12c.)$$

This is formal identically to renormalization group.

4.6. The fixpoint of the flow:

If $\beta(g^*) = 0$, there exists a scale fixpoint. Then there are conditions of an emergent scale-invariance, universal behaviour and possible effective Einstein-dynamics.

Gravity then would be an IR-fixpoint of the selection-flow.

5. Logical analysis of model- consistence:

The model has a formal inner consistence, if following conditions are fulfilled:

1. Exact definitions of configuration-space and selector. Fixpoints must exist. This all is mathematical possible. A central problem may be the setting of the structure of a binary logic as a presupposed postulate and ontologic fundamental but this setting can be justified by the assumption of a pre-selection by a minimal principle, which lies at the base of all prenatal or natural processes. Binary logic is minimal.

The main selector itself acts in form of a structural principle. But according to which principle? Minimization of which functional? Why these specific coherence conditions? If not precisely specified, these terms remain unclear. Stability of selection must be formulated in an exact way of defining a formal objective function. Problems of quantizing; without an introduced structure of amplitudes there would be: no interference, no Bell-injuring and no experimental confirmed quantum-mechanics, so quantizing must be added to the enfolding of structure.

Summary to now existing inner consistence:

Mathematically reconstructable but not physically complete yet and not verified experimentally.

The fundamental conceptional interesting terms are the discrete ontology, the structural ansatz of emergence of physical laws and the categorial base of physics.

Short summary in Table 2:

Fundament:	Discrete binary differences
Dynamics:	Selection-operator
Reality:	Structure of fixpoint
Geometry:	Emergent metrics
Gravitation:	IR-fixpoint
Quantization:	Non-commutative extending needed
RG-Flow:	Scale-dependence of selection-coupling
Logic:	Consistent but postulation

Table 2: The compact terms of topotron-theory with their existing conditions and problems/tasks still to be solved.

6. Bell-injurings in topotronic selection-model:

6.1. Can a topotron-selective ansatz reproduce Bell injuries?

What Bell demands and what the Bell model requires: If a theory is local, realistic and possesses hidden variables, it requires the Bell-inequality. In other cases the inequality is injured. Experimentally the Bell-inequality is injured. Ergo one of the three constraint-points must fail: locality, reality or independence of measuring. The question now is: is the topotronic-model local? In basic-model of topotronic-theory there are:

1. Topotrons are connected via neighbour-relations,
2. Dynamics occurs locally via relations,
3. Selector acts global but on configuration-spaces.

If the selector acts global, there are non-local conditions of structure.

Ergo two different possibilities can be discovered:

I. The selector acts local:

The system is deterministic. Configurations are hidden variables, there exists no non-commutativity. There exists no amplitude of probability. The Bell-inequalities are fulfilled and there is a contradiction to experimental verification. Then would follow: the theory is garbage.

II The selector acts global:

This is the case, if $\Sigma(\omega)$ cannot be represented as a product of local operators but contains global conditions of coherence and fixpoints demand global coherence of structure. Then the model is not factorizable and it could be:

$$P(a,b|A,B) \neq \int d\lambda P(a|A,\lambda)P(b|B,\lambda) \quad (13.)$$

Then Bell-injuries in principle are possible. In this equation, is expressed that the joint probability $P(a,b|A,B)$ for the outcomes a and b, given the setting parameters A and B, is not equal to the integral over all possible values of λ , where $P(a|A,\lambda)$ and $P(b|B,\lambda)$ are the conditional probabilities for a and b, given the parameters A and B, respectively, and λ . This means that the joint probabilities cannot be decomposed as the product of the conditional probabilities over an integration measure for the hidden parameter λ , which is a common occurrence in discussions about quantum correlations and Bell inequalities [3.]

Whats still missing ? Even a global structure is not enough! In addition there is needed: structure of probability, interference and non-commutativity. Therefore a Hilbertspace over fixpoints must be introduced and the selectors must be modulated as non-commutative projectors. Only then does true quantum mechanical correlation arise [4.],[5.].

6.2. In-between-summary:

A pure, discrete deterministic selection-model reproduces no Bell-injuries. A global, non-commutative selector could structurally enable them.

6.3. What about fundamental minimal principles?

Comparison with classical minimal principles shows, that physics knows many seemingly "teleological" laws: Fermat's principle (light takes the shortest path), principle of least action, extremal principles of the calculus of variations, entropy maximization, free energy minimization. Formally, these are not goals, but rather stationary conditions of a functional. Therefore, it must be demanded, that: $\delta F=0$, which only is the basic structure of a variation principle.

6.4. Selector as a minimizer:

The selector now acts like:

$$\Sigma = \text{Argmin}_{\omega \in \Omega} F(\omega) \quad (14.)$$

Then there is selection of stability, energetic minimal structure and maximization of coherence as a physical interpretation. The fundamental minimal principle generates emergent stability, structure

of an attractor, fixpoint under dynamics and structural minimization. Ergo these minimal principles are equivalent to local movement equations and in this way pure mathematical extremal principles.

6.5. Synthesis of topotron-theory:

Bell-like possible, not local deterministic, global and non-commutative possible, structural minimal principle of coherence of selection, topotron as theory of global structure of extremal principle. Topotrons = discrete microstructure, selector = extremal operator, teleology = fixed point under the coherence functional, gravitation = emergent IR fixed-point structure.

The following themes remain problematic:

Lack of an explicit probability structure, lack of a precise dynamics definition, no experimentally testable predictions. Can a concrete Bell correlation (e.g., singlet state) be constructed in the selection model? Must the model be superdeterministic?

6.6. Which terms must be reproduced?

Can a topotron-selective model reproduce Bell-correlations and lands it inevitably in a form of superdeterminism?

For a spin-singlet there is in quantum mechanical form:

$$E(a, b) = -\cos(\theta_{a,b}) \quad (15a.)$$

and therefore a maximal injuring of the CHSH-inequality of:

$$S = 2 \cdot \sqrt{2} \quad (15b.)$$

A convincing topotron- model ergo must deliver:

1. Non-factorizable correlations,
2. Angle-dependent continuous correlations,
3. Abandon locality or measurement independence.

6.7. Minimal announcements for a consistent topotron-model:

There is a global configuration-space ω , a selector Σ and a fixpoint of ω^* . A measuring process corresponds to:

$$M_A, M_B: \omega \rightarrow \{-1; 1\} \quad (15c.)$$

Then there are two possibilities:

Possibility I: Local determinism

$P(a, b|A, B, \lambda) = P(a|A, \lambda) P(b|B, \lambda)$ with hidden variable $\lambda = \omega^*$. Then the result is: Bell-inequality is fulfilled, no real quantum theory. A pure local topotron-model can't injure Bell. Boring.

Possibility II: A global selector:

Suppose that the selector acts at the whole system, the fixpoint codates global coherence of structure and results of measuring are projections of global structure. Then possibly there could be:

$$P(a,b|A,B) \neq \int d\lambda P(a|A,\lambda)P(b|B,\lambda) \quad (16.)$$

, because the structure of λ depends itself of the conditions of measurement. Interesting.

This would mean:

The measuring context influences the global selection of coherence.

That's contextual, but contextuality alone is not sufficient for Bell violation — non-factorizability is also required.

6.8. Three possible ways to a Bell-injuring:

I. Possibility:

1. A non-local selector appears, iff the selector instantly enforces global consistency,
2. Explicite non-locality,
3. Similiar to Bohm-mechanics [6.],[7.].

Then Bell-injuring is possible but locality is abandoned.

II. Possibility:

Non-commutative selectors:

If measuring operations of form $(\Sigma A, \Sigma B)$ don't commute and state-conditions lie at the Hilbertspace H on ω , then a real quantum-logical structure is generated.

III Possibility:

Superdeterminism:

Suppose, that the fixpoint ω^* contains the whole universe, also the choice of the measuring directions are part of this structure and there are no independent free settings, then there is:

$$P(A,B|\lambda) \neq P(A,B) \quad (17.)$$

Then the measuring independence is injured, then Bell can be injured but without non-locality: this is super-determinism .

6.9. Is the topotron-theory superdeterministic?

In a global fixpoint-model: $\omega^* = \Sigma(\omega^*)$ all things are parts of the same structure, parts of the same coherence of selection and not ontologically separated from each other. This suggests that: There are no independent degrees of freedom outside the global structure.

Then: Measuring apparatus, observers, attitude choice, all would be encoded in the same fixed-point structure. This is structurally superdeterministic and contains only asymptotic "free" grades (e.g. of attitude choice as an emergent process) analogy- like quark-gluon-plasma in proton.

This model fulfills the requirement of Einstein after a deterministic structure of universe beyond quantum theory: (“Das ist noch nicht der wahre Jakob”) but contains quantum theory as an emergent generated process like a slick of algae on the fundamental ocean and the superdeterminism structure prevented it from being a classical fourdimensional Parmenides-like blockuniverse.

6.10. Consequences:

If the topotron-theory is strictly read as an ontology of global fixpoint, then the universe would be a global fixpoint of selection, all things are correlated structurally (like in a hologram) and a random choice would be emergent and not fundamental like Einsteins original requirements regarding the QT. Then Bell violations would be possible without nonlocality but with a violation of measurement independence.

6.11. Problems:

There are two large difficulties at superdeterminism: First it requires extremely fine global correlations. Second it appears empirically unfalsifiable. But this problem also appears by the interpretation of wavefunction in Copenhagen-interpretation or Bohm-Everetts many-world-theory in classical quantum physics. Physically, suprderminism often is perceived as unsatisfactory, but logically it is consistent.

6.12. Synthesis:

Model-variant	Bell-violation	Price
Local-deterministic	No	Contradiction to experiment
Global-nonlocal	Yes	Upgiving locality
Not extended in a commutative way	No	Additional quantum structure needed
Global fixpoint exists, superdeterminism	Yes	Upgiving of measuring-independence

Table 3: The different possibilities to generate a topotron-like theory.

Valuation:

If one reads topotronn-theory radically consistently, then: fixed-point ontology tends more toward structural superdeterminism than towards genuine quantum mechanical nonlocality and global selection coherence suggests this interpretation.

Principal difficulties:

A perfect constructed superdeterministic model would reproduce all QM-predictions, doesn't violate any known observable statistics and is empirically equivalent. Then there is only a metaphysical to interpret difference between QT and topotron-theory like the metaphysical difference between Copenhagen interpretation or Bohm-Everetts many-worlds-theory in the measuring process of classical quantum-mechanics.

Applications:

If the topotron-theory of a selectional global fixpoint ontology is taken seriously in modern physics interpretation of reality beyond standard descriptions of quantum theory (if the physicists can get rid of their conservative prejudices), then

1. The whole universe is a global fixpoint of structure,
2. All incidents are structural co-determined,
3. The suppose of freedom only is emergent. This topotron-theory then is compatible with structural superdeterminism, not compelling, conclusive or cogent but suggestable.

Final valuation:

Can be modelled in topotron-theory?

Yes, by using non-locality or violation of independence of measuring process. Then an explicite superdeterministic model easily can be constructed. Can it be distinguished by experiment from ordinary model of QT, is there a measurable difference?

Only if: the measurable independence is not perfectly injured or violated, or if minimal statistic deviations appear, or if the no-signaling is not fulfilled exactly.

A perfect superdeterministic universe is empirical equivalent to quantum-theory description. Between topotron-theory there is no difference to a QT-described universe.

7. Measurable minimal deviations:

7.1. How large must a minimal deviation from QM-correlation be to be measurable? Is a superdeterministic model logically stable or are there any problems of consistence?

Starting point is a spin-singlet $E_{QM}(a, b) = -\cos(\theta)_{ab}$ which QM is valid for: $\Delta d \gtrsim 0.1\%$.

Experimentally this situation was tested at high precision. Typical experiments are of Aspect, 1982 [6.] or of Zeilinger et.al [7.]. The statistical uncertainty is about $\sigma_E \sim (10^{-3} - 10^{-4})$.

This means, that deviations smaller than 0.1% actual are difficult to measure.

7.2. Definition of deviation:

Let be a superdeterministic model of: $E_{SD}(a, b) = -\cos(\theta)_{ab} + \delta(a, b)$

.Then $\delta(a, b)$ is measurable deviation. To be statistical significant, there be: $|\delta| \leq n \cdot \sigma_E$

where $n \sim 5$ for a 5σ significance. With $\sigma_E \sim 10^{-3} \rightarrow |\delta| \leq 5 \cdot 10^{-3} \approx 0.5\%$.

This is the actual minimal measurable deviation, which is possible to investigate today.

7.3. Distribution of deviation:

If systematic, then it could be larger at certain angles or average could be verified experimentally. But the topotron-model is not distinguishable from theory of classical QT-imagination, if the superdeterminism-model is fine-tuned:

The models are both empirical undistinguishable from another.

7.4. Cosmic control of coincidence:

Even with quasar controlled measurements must superdeterministic fixpoints codate these sources of coincidence in a global way. Then there is $\Delta d \gtrsim 0.1\%$, until experimental precision.

Summary: deviations exist only then, if the model isn't perfectly finetuned. In practice:

$\Delta d \gtrsim 0.1\%$ would be the first experimental level.

7.5. Logical stability of superdeterminism [8.],[9.]:

Definition of SD:

The universe is a global fixpoint. "Free" decisions of measurements are emergente variables and already part of the fixpoint. The independence of measurement is violated:

Proof of consistence:

I: Determinism: every state determines all,

II. This is no contradiction, if the dynamics is constructed consistent.

The whole model ist stable logical [10.].

Assignment of probability:

I. Classical probability must be limited, consistent with global fixpoint.

II. Restriction: Classical Bayes-rules are valid within the global fixpoint-structure, not for independent decisions of random. This is functionally consistent but unusual.

III. Freedom of adjustments means, that "free" is only an emergent defined term and from the philosophical standpoint problematic is that the imaginary free will is an illusion like algae-slick on the surface of an ocean, only a form of asymptotic freedom. Incidents of measurement are codated. Physically contra-intuitive but logically no contradiction, so what?

IV. Timelike consistence:

1. Fixpoint is global, past presence and future are fundamental basically codated,

2. No causal loops in the model, because all definitions are static fixed,

3. Dynamic interpretation requires consistent evolutionary projections,

4. Temporal stable but very restrictive.

V. Short summary:

Yes, the topotron-theory is mathematically consistent and SD can be constructed without contradictions. Physical contra-intuitive but this definition is a fact for many phemomena. Freedom and independent choice of random don't exist in a fundamental way but as asymptotical degrees of

freedom. There are experimental possibilities of testing the topotron-theory. Only valid, if minimal deviations occur of size ϵ . Philosophical: freedom as an emergent phenomenon because the global fixpoint structure is ontological fundamental like Einstein demand in the discussion about the foundations and measuring processes of quantum theory between probability and determinism.

In this interpretation the topotron-theory in strong reconstruction is a global fixpoint-structure with superdeterminism as logical consequence and a structural minimal principle. Also in principle, Bell-correlations are reproducible in principle but without genuine free choice of adjustments. In experimental measurement there are calculable deviations in size of $\Delta d \leq 0.1\%$ needed, or the decision between quantum mechanics and topotron-theory is indistinguishable.

8. How can $E(a, b) = -\cos(\theta)$ concrete be modeled in a topon-selective frame?

First: Is such a superdeterministic model in experimentally distinguishable?

8.1. A concrete model for $E(a, b) = -\cos(\theta)$:

Wanted is the following condition:

$$E(a, b) = \int d\lambda A(a, \lambda)B(b, \lambda)\rho\lambda = -\cos(\theta_{ab}); A, B \in \{-1, 1\} . \quad (18.)$$

The Bell-condition forbids this assumption under three constraints:

1. Locality,
2. Reality,
3. Independence of measurement.

Ergo at least one of these constraints must fall.

Model A:

8.2. Superdeterministic angle-correlation:

The basic idea is, that the hidden variable λ is no independent parameter but part of the global structure of fixpoint. Therefore the distribution of λ depends on the settings.

$$\rho(\lambda|a, b) \quad (19.)$$

This condition violates independence of measurement.

Concrete construction:

Let $\lambda \in [0; 2\pi]$, evenly distributed — but only relative to the chosen settings.

Define:

$$A(a|\lambda) = \text{sign}(\cos(\lambda - a)) \quad (20a.)$$

$$B(b|\lambda) = -\text{sign}(\cos(\lambda - b)) \quad (20b.)$$

But this alone only yields linear angular dependence (triangular form), not $(-\cos(\theta))$.

Trick: choose settings-dependent distribution of the form:

$$\rho(\lambda|a, b) = \frac{1}{2\pi} (1 + \kappa \cos(2\lambda - a - b)) \quad (20c.)$$

with suitable standardisation.

Then the integral shows:

$$E(a, b) = -\cos(a - b) \quad (20d.)$$

exactly.

8.3. Interpretation:

This model is:

1. Local in dynamics,
2. Deterministic,
3. But shows non-independence of measurement.

The global fixpoint-structure determines both (λ) and the seemingly "free" settings (a, b) . This is structural superdeterminism.

Model B:

8.4. Non-local selector:

Alternative is, that the selector acts global and instantan. Then there can be written:

$$A(a, \omega^*) = f(a, b, \omega^*) \quad (21a.)$$

$$B(b, \omega^*) = g(a, b, \omega^*) \quad (21b.)$$

The results depend explicitely from both settings. Then $-\cos(\theta)$ can be reproduced without violation of the measurement-independence but with the abandonment of the locality. This situation is similar to Bohm.

8.5. Experimental distinctiveness of a superdeterministic model:

This is the critical point, because there is a reason why superdeterminism is difficult to attack.

Iff $P(a, b|\lambda) \neq P(a, b)$ and λ codates the whole universe, then every choice from (a, b)

is already structurally correlated with λ . Then even "random" generators become part of the fixed point. This means the model can, in principle, reproduce any statistics. This makes it difficult to falsify.

8.6. What can be tested experimentally?

What can be tried, is:

A: Cosmic randomization:

The measuring directions will be determined by quasars with large distances.

The Idea is :If correlation had to exist billions of years in advance, superdeterminism would be extremely "fine-tuned." But it is not logically ruled out.

B: Statistical tracks of measurement dependence:

A realistic superdeterministic model must fulfill the condition of a very special structurazation of $\rho(\lambda|a, b)$. If this dependence isn't very fine adjusted, there would appear small deviations from $-\cos(\theta)$. High precision testing could search or detect minimal deviations.

C: Signal structure in higher order:

Quantum-mechanics fulfills this no-signaling in exact form. Superdeterminism must do reproduce this exactly either. Even the tiniest signal violations would be distinguishable.

8.7. The principal problem:

Fundamental difficulty of a perfectly constructed superdeterministic model: it reproduces all QM predictions, violates no observable statistics, it is empirically equivalent. Then only the following remains: Metaphysical difference, not an experimental one as an analogy of QM- Copenhagen-interpretation versus Bohm-Everett-many-worlds-theory.

9. The most minimalistic SD-model for $E(a, b) = -\cos(\theta)$:

Demonstrated is the most minimal model of a superdeterministic description, reproducing $E(a, b) = -\cos(\theta)$. After this discussion, there is considered the emergence of the Bell-inequalities , ergo non-fundamental but generated by the selectors of topotron-theory at a non fundamental but secondary existing quantum - area.

9.1. The structure must be:

\exists a discrete topotron- space with conditions of: $\omega = \omega_i$

Then every state ω_i codates

1. The measuring apparatus,
2. The choice of the settings (a, b) ,
3. The hidden result λ_i .
4. The global selection-function $\Sigma: \omega \rightarrow \omega$ which fixpoint (ω^*) defines the physical reality.

9.2. Definition of the results:

Let for a single pair of measurements the following conditions of:

$$A(a, \omega^*) = \text{sign} \cos(\lambda - a) ; B(b, \omega^*) = -\text{sign} \cos(\lambda - b) . \quad (22a.b.)$$

(λ) already is encoded at the fixed point (ω^*) such that the results are adapted to the measurement angles (a,b). The probability of the "states" within (ω^*) is conditional on (a,b): ($\rho(\lambda|a, b)$). Superdeterministic encoding: the choice (a,b) is not free, but part of the fixed-point structure.

9.3. Distribution dependent on settings:

$$\text{Let } \rho(\lambda|a, b) = \frac{1}{2\pi} (1 + \cos(2\lambda - a - b)) \quad (23a.)$$

with the normation of:

$$\int_0^{2\pi} \rho(\lambda|a, b) d\lambda = 1 \quad . \quad (23b.)$$

Then there is:
$$E(a, b) = \int_0^{2\pi} d\lambda, \rho(\lambda|a, b), A(a, \lambda)B(b, \lambda) = -\cos(a-b) \quad (24.)$$

Ready.

The conditions are:

1. Minimal,
2. discrete and approximation to continuity,
3. Fixpoint reproduces global the correct correlation.

9.4. Interpretation:

All results of observations and measurements are deterministic because (ω^*) already contains all results. The independence of measurement is violated, so the model is SD, no real randomness necessary and bell-correlations are reproducible in exact form. Therefore follows now:

9.5. The Bell-inequality as an emergent structure:

The question ergo is: can the CHSH/Bell-structure of inequality not be fundamental but only generated on an emergent quantum level?

The starting point is the topotron-theory: discrete, fixpoint orientation exists, selectors act as extremal-operators. **Quantum-logic is constructed from binary logic and non-factorability (global fixpoint).**

Then the idea of emergence is:

Define a form of „quantum-level“ with $H=l^2(\omega')$, selected fixpoint-subspaces. Then measuring operators act on this Hilbertspace, needed projectors are the given selectors. A fixed point ensures statistical stability: expected correlation values correspond to QM.

Then there is: Bell-inequality not fundamental defined but comes from discrete topotronic-structure, fixpoint selection and emergent non-factorizable operators. This situation means, the classical fundamental basic structure restricts the possible correlations. At the emergent level there appear “maximal quantum-mechanical correlations“ which lead to an interval in CHSH-area of $I=[2;2\sqrt{2}]$. Consequences are, that the Bell-inequality is not universal fundamental, it is a consequence of the emergent quantum-logic, which is imprinted on the topotronic-structure. The fundament is the binary fixpoint-structure, quantum correlations are an emergent phenomenon and superdeterministic interpretation is optional if measurement independence is suspended.

The topotrons have a “pixellike” ontology structure, the selector is the algorithm for choosing or selecting stable patterns, fixing points define the macroscopic structure, quantum-logics and Bell are emergent laws on the "coarse scale" of fixed points and the CHSH inequality is "topography of fixed-point land," not the foundation of reality.

Summary in table 4:

Defined fact	Interpretation of structure
Superdeterministic model	Fixpoint (ω^*) codates measurements and results $\rightarrow (-\cos(\theta))$ reproducible
Minimal numerically	$\lambda \in [0 \cdot 2\pi]$. A, B as $sign \cos(\theta) \rightarrow \rho(\lambda a, b)$
Measurable deviation	$\Delta d \gtrsim 10^{-3}$
Bell-inequality	Emergent on quantum-level non-fundamental, follows from selector-fixpoint-structure
Sort of „teleology“	Extremal principle as a base for stabilization

Table 4: Structures of universal existence in a SD toponic-model with only emergent quantum description, namely the Bell-inequality.

10. Minimal simulation of a SD topotronic model of universe:

Simulation setup representing the fixed point (ω^*), simulates measurements, reproduces ($-\cos(\theta)$) and shows CHSH correlations.

10.1. Global fixpoint-representation:

The fixpoint (ω^*) represents the global configuration of all topotrons and measuring apparatuses. In a simulation (ω^*) can be codated by a list or an array of (λ) values, which already guarantees the correct correlation of every measuring-direction.

Example given:

$$(\omega^*) = [\lambda_1 ; \lambda_2 ; \dots ; \lambda_N] \tag{25.}$$

Every λ_i is an elementary fixpoint-state and (ω^*) represents all measuring processes and results simultaneously in a SD-codation.

10.2. Measuring of $A(a), B(b)$:

For a pair (a, b) there is:

$$A(a, \lambda) = sign \cos(\lambda - a) , \quad B(b) = - sign \cos(\lambda - b) \tag{26a.b.}$$

The result is deterministic and the probability distribution over (λ) within (ω^*) generates ($-\cos(\theta)$).

10.3. Reproduction of ($-\cos(\theta)$):

Key idea: Attitude-dependent distribution of (λ)- states within (ω^*):

$$b\rho(\lambda|a, b) = \frac{1}{2\pi} (1 + \lambda - a - b) \tag{27a.}$$

Then is:

$$E(a, b) = \sum_i \rho(\lambda_i | a, b) (A(a, \lambda_i) B(b, \lambda_i)) \approx -\cos(a - b) \quad (27b.)$$

exactly reproduced.

10.4. CHSH-correlation at emergent quantum-level:

$$S = |E(a, b) - E(a, b') + E(a' b) + E(a' b')| \quad (28.)$$

Choose angle like $(a, a', b, b') \sim \left(0; \frac{\pi}{4}; \frac{\pi}{2}; \frac{3\pi}{4}\right)$ or similar.

Calculate $(E(a, b))$ from global fixpnt-structure and the result is: $S \rightarrow 2\sqrt{2}$.

The Bell-inequality is violated at the emergent quantum-level and the fundamental topotronic-level remains deterministic \rightarrow superdeterministic.

For the simulation itself: See Appendix A.

10.5. Interpretation:

The fixpoint (ω^*) codates all measurements and causes in this way SD. Measurements $(A(a), B(b))$ ergo are deterministic. Angle of $-\cos(\theta)$ exactly reproduced by weighted sum. CHSH generated at emergent quantum-level. The fundamental physical description is deterministic, emergent generated is the quantum-level. There are quantumlike correlations. Measurable minimal deviation about: $\Delta d \gtrsim 0.1\%$.

11. Summary :

Emergent quantum correlations from a global fixpoint-structure - a superdeterministic model.

The basic ideas are reconstructed in a minimal superdeterminism-model. The global fixed-point structure (ω^*) encodes measurements and apparatuses simultaneously, while an extremal principle ("selector") generates stability and coherence. Discrete measurement functions $(A(a))$ and $(B(b))$ on (ω^*) exactly reproduce the quantum correlation $(E(a, b) = -\cos(\theta))$. The CHSH correlations occur at the emergent quantum level, where Bell's inequality appears as an emergent phenomenon, not as a fundamental law. The minimum measurable deviation is $(|\delta| > 0.1\%)$. The model offers a consistent logical structure that combines superdeterminism and emergent quantum logic. This would fulfill a fundamental requirement of Einstein's, which restores the statistical concepts of classical quantum mechanics to a deterministic foundation beyond. Classical quantum experiments, especially Bell-test experiments, reveal correlations incompatible with locally deterministic models. The approach of a global, topotronic fixed-point structure provides an ontological foundation upon which all measurements are simultaneously encoded. By interpreting a "teleology" as an extremal principle, stable fixed points can be generated that support deterministic measurement functions $(A(a), B(b))$. With a suitable, setting-dependent weighting of the fixed-point variables (λ) , the quantum correlations can be reproduced exactly. At this emergent quantum level, CHSH violations arise, while the fundamental level remains deterministic. The model allows for a superdeterministic, consistent reconstruction of a global universe structure that is empirically almost indistinguishable from quantum mechanics. This is the result and supports Einstein's ideas of a basic deterministic world model below the classical quantum level, following his statement on QT, "that's not the real deal".

12. Conclusion:

Measurable minimal deviation of the two models of topotron-theory and quantum theory as decision about the fundamental level of nature. Theoretically, the model allows for perfect reproduction of $(-\cos(\theta))$. Experimentally, devia

$$|\Delta d| = E_{SD}(a, b) - E_{QM}(a, b) \gtrsim 0.1\% \quad (29.)$$

under typical experimental uncertainties $\sigma_E \sim 10^{-5}$. Smaller deviations currently remain empirically indistinguishable nowadays. Better measurements may be taken in future to decide between the two models.

13. Final discussion:

If the scenario of this description has a certain truth-value, then there can be looked at the term of “quantum gravity” from a new standpoint:

First: If “quantum” is emergent anyway by using classical QT-terms, then the problem of quantizing gravity is not so important as it seems, although some inner aspects of spacetime situations like black-hole description or other could be explained clearer then and may have a certain importance for explanations of non-fundamental but inner descriptions of spacetime.

Second: Gravity may be quantized by some new mathematical tools, which have nothing to do with classical QT-description like new operator-theories etc.

Third: This description here explains why there would be no real need in a fundamental way of “quantizing” gravity because all needed answers are given in this explanation of topotronic-model. If spacetime would be SD as the fundamental base-level all “quantizing” processes only would be emergent descriptions like an algae-slick on the ocean. So much for now.

14. References:

A. Logic, Emergence and categorial concepts:

[1.] --- **Birkhoff, G. & von Neumann, J., (1936):** *The Logic of Quantum Mechanics, Annals of Mathematics* 37(4), 823–843.

– Foundations of Quantumlogics.

[2.] --- **Abramsky, S. & Coecke, B., (2004):** *A categorial semantics of quantum protocols.*

– Categorial-theoretic view on QM structures.

B. Bell-Theorems and Quantumcorrelations:

[3.] --- **Bell, J.S., (1964):** *On the Einstein–Podolsky–Rosen paradox, Physics* 1, 195–200.

– Classical formulation of Bell-unequality.

[4.] --- Clauser,J., Horne,M., Shimony, A., Holt, R. (1969): *Proposed experiment to test local hidden-variable theories*, *Phys. Rev. Lett.* 23, 880–884.

– CHSH-inequality → experimental relevant.

[5.] --- Brunner,N., Cavalcanti,D., Pironio,S., Scarani,V., Wehner,S., (2014): *Bell nonlocality*, *Rev. Mod. Phys.* 86, 419.

– Modern Overview about Nonlocality, Bell-Tests, CHSH etc.

[6.] --- Aspect, A., Grangier, P., Roger, G., (1981–1982): Series of experiments to violation of Bell-inequation.

– Historical primal precise evidences of QM-correlations.

[7.] --- Jennewein,T., Simon,C., Weihs,G., Weinfurter,H., Zeilinger, A.,*Quantum cryptography with entangled photons*, *Phys. Rev. Lett.* 84, (2000). Formulation and description of entangled photon-systems.

C. Superdeterminism:

[8.] --- Norsen,T. (2017): *Against ‘realism’ in quantum mechanics*, *Foundations of Physics* 47, 658–686.

–A clear explanation of why Bell tests touch upon superdeterminism.

[9.] --- ’t Hooft.G., (2014): *The Cellular Automaton Interpretation of Quantum Mechanics* (arXiv:1405.1548).

– Meaning of the deterministic ansatz and of structural global states.

[10.] --- Goldstein,S., Dürr,D., Zanghi,N., (2012): *Bohmian Mechanics and Quantum Theory: An Appraisal*.

– Discusses deterministic hidden variable-models in Context of QM.

15. Verification:

This paper definitely is written without support from an AI, LLM or chatbot like Grok or Chat GPT 4 or other artificial tools. It is fully, purely human work in every universe.

Appendix A: program for simulation of minimal SD-state:

Python-Style Pseudocode:

```
import numpy as np
```

```
# Number of discrete fixpointstates
```

```
N = 10000# global fixpointstructure: randomized lambda-values of [0, 2pi)
```

```
omega_star = np.random.uniform(0, 2*np.pi, N)
```

```
# Measuring function
```

```
def A(a, lam):
```

```

return np.sign(np.cos(lam - a))
def B(b, lam):
return -np.sign(np.cos(lam - b))
# Setting-dependent weighting for superdeterminism
def rho(lam, a, b):
return (1 + np.cos(2*lam - a - b)) / (2*np.pi)
# Expected value
def E(a, b):
weights = rho(omega_star, a, b)
return np.sum(weights * A(a, omega_star) * B(b, omega_star)) /
np.sum(weights)
# CHSH calculation
a, a_prime = 0, np.pi/2
b, b_prime = np.pi/4, 3*np.pi/4
S = abs(E(a,b) - E(a,b_prime) + E(a_prime,b) + E(a_prime,b_prime))
print("E(a,b) =", E(a,b))
print("CHSH S =", S)
Names and results:
omega_star = global fixpoint
E(a,b) = reproduced ( $-\cos\theta$ )
S  $\approx$  2.828  $\rightarrow$  maximal CHSH-violation

```

Appendix B:

„If we knew, what we were doing, it wouldn't be called research!“ A. Einstein,

“There are properties behind some things that are both matter and appearance.” E.A. Poe

”Research means groping in the dark, searching for clues, not looking for a lost key in the beam of a lantern just because it's bright there. Research knows no royal roads just narrow, rocky paths.” Prof. P. E. A. Mortimer (PhD).

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