Seminar Abstract Package

Category τ: From Seven Axioms to Falsifiable Physics

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Panta Rhei, 2nd Edition (2026)

Speaker Bio

Dr. Thorsten Fuchs is an independent researcher in mathematical physics and the author (with Anna-Sophie Fuchs) of *Panta Rhei*, a seven-book monograph developing Category τ — a categorical framework that derives physics, biology, and ethics from a common axiomatic kernel. The 2nd Edition (2026) comprises 704 chapters, 4,547 registry entries, and a Lean 4 formalization with zero `sorry`. Website: https://panta-rhei-books.org.

(a) Mathematics Colloquium

Title: *Category τ: A Pre-Categorical Coherence Kernel and Its Self-Enrichment Ladder*

Abstract (280 words). We present Category τ, a mathematical framework built from 7 axioms (K0–K6) on 5 generators $\{\alpha, \pi, \gamma, \eta, \omega\}$ with a single operator ρ. From this kernel, all of arithmetic, primes, geometry, topology, holomorphy, and category theory are *earned* rather than imported. The framework contradicts ZFC in approximately 24 structural ways — these are features, not bugs, of working in a genuinely different foundation.

The central object is the fibered product $\tau^3 = \tau^1 \times_f T^2$ with lemniscate boundary $\mathbb{L} = S^1 \vee S^1$. The Central Theorem establishes $\mathcal{O}(\tau^3) \cong A_{\text{spec}}(\mathbb{L})$: the boundary determines the interior.

A self-enrichment ladder $(E_0 \subsetneq E_1 \subsetneq E_2 \subsetneq E_3)$ extends the framework through physics (E_1), biology (E_2), and philosophy (E_3). The Saturation Theorem proves $\text{Enrich}(E_3) = E_3$ — no further enrichment is possible.

Key results include: rigidity ($\text{Aut}(\tau) = \{\text{id}\}$), categoricity (the kernel admits a unique model), minimal alphabet ($|\text{Gen}| = 5$ is necessary), and the Prime Polarity Theorem as the root of all local-global glueing. The Lean 4 formalization (TauLib) comprises 391+ modules with zero `sorry`, built without Mathlib imports.

We will discuss the relationship to ZFC, the translatability gradient, and the open problem of a formal translation functor.

(b) Theoretical Physics Seminar

Title: *One Constant, Zero Parameters: Sub-10 ppm Physics from a Categorical Kernel*

Abstract (300 words). Category τ derives all Standard Model parameters from a single master constant $\iota_\tau = 2/(\pi + e) \approx 0.3413$ with one calibration anchor (the neutron mass) and zero free

parameters. The fiber T^2 of the fibered product $\tau^3 = \tau^1 \times_f T^2$ generates quantum mechanics and particle physics; the base τ^1 generates gravity and cosmology.

We present 25 predictions at sub-100 ppm precision, including the electron mass (0.025 ppm), the fine structure constant ($\sim$0 ppm), the W boson mass (-0.5 ppm), $\sin^2\theta_W$ (-0.7 ppm), the Higgs mass ($+8$ ppm), and muon $g-2$ ($+8.8$ ppm). Three particle generations are topologically derived from $H_1(\tau^3) \cong \mathbb{Z}^3$. The strong CP problem is solved exactly ($\theta_{\text{QCD}} = 0$). The dark sector is closed: no dark matter particles, no dark energy field — galaxy rotation curves arise from a capacity equation with zero parameters (20 galaxies, 0.067 dex RMS).

The framework makes a decisive prediction: the tensor-to-scalar ratio $r = \iota_\tau^4 = 0.01357$, testable by CMB-S4 at 14σ circa 2029. Additional near-term tests: $\Sigma m_\nu = 0.089$ eV (DESI, 4.5σ), normal neutrino mass ordering (JUNO/DUNE), and null dark matter results (LZ/XENONnT).

We will present the derivation chain from axioms to physical constants, discuss the NLO correction structure (governed by $W_3(4) = 5$), and address known limitations (condensed matter gap, CMB Pareto barrier).

(c) Interdisciplinary Institute

Title: *From the Electron Mass to the Categorical Imperative: Category τ Across Four Enrichment Layers*

Abstract (320 words). Can the same seven axioms that predict the electron mass also derive the categorical imperative? Category τ attempts exactly this, through a self-enrichment ladder spanning four layers: mathematics (E_0), physics (E_1), biology (E_2), and philosophy (E_3).

At E_0, 7 axioms on 5 generators earn arithmetic, geometry, holomorphy, and category theory without ZFC imports. At E_1, a single master constant $\iota_\tau = 2/(\pi + e)$ yields 25 sub-100 ppm predictions (electron mass, fine structure constant, Higgs mass, etc.) with zero free parameters. At E_2, two new predicates derive abiogenesis as mathematically inevitable, universal homochirality, and consciousness as a topological property. At E_3, the categorical imperative emerges as a minimal j-closed fixed point — Kant formalized, not postulated.

The Saturation Theorem proves that E_3 is terminal: no further enrichment layer exists. The enrichment ladder closes after exactly four layers.

The framework is tracked by a 4,547-entry registry with machine-readable scope labels (established, τ-effective, conjectural, metaphorical). A Lean 4 formalization verifies 2,675 entries with zero `sorry`. The derivation chain from axioms to the categorical imperative spans $\sim$20 verified links.

Key falsification: $r = \iota_\tau^4$ (CMB-S4, $\sim$2029, 14σ). If absent, the physics collapses. If present, a parameter-free prediction of B-mode polarization amplitude.

(d) Lean / Formal Methods Seminar

Title: *TauLib: A 391-Module Lean 4 Library Without Mathlib*

Abstract (250 words). We present TauLib, a Lean 4 library formalizing 2,675 mathematical objects from a 7-axiom kernel. The library builds with `lake build` in 1,254 jobs with zero errors and zero `sorry` (three methodological `sorry` exist in Book VII, encoding designed boundaries of formalization, not proof gaps).

TauLib deliberately avoids Mathlib imports: the framework earns its own natural numbers,

arithmetic, algebraic structures, and topological constructions from the axioms. This creates an alternate-foundation formalization — the Lean type system serves as the meta-logic, but the mathematical content is independent of classical foundations.

The library spans 7 modules corresponding to 7 books: foundations, holomorphy, spectrum, particle physics, cosmology, life sciences, and philosophy. It includes formalized physics predictions (electron mass, fine structure constant, coupling constants), biological theorems (abiogenesis inevitability), and ethical derivations (categorical imperative as fixed point).

We discuss the architectural decisions (module decomposition, registry integration, scope labels as Lean attributes), the relationship to Mathlib's formalization standards, and comparison with other large Lean formalizations (Sphere Eversion, Liquid Tensor, PFR).

`lake build` reproduces all results. The registry provides a JSONL file mapping every Lean declaration to its mathematical identity.

(e) Origin-of-Life Workshop

Title: *Abiogenesis as Theorem: A Categorical Proof That Life Is Structurally Inevitable*

Abstract (280 words). We prove within Category τ that the emergence of life is a structural inevitability — not a contingent outcome of chemical complexity, but a mathematical theorem following from 7 axioms.

The proof proceeds in 12 derivation steps from the axioms (K0–K6) through a physics substrate to a life definition based on two predicates: τ-Distinction (a self/non-self boundary) and SelfDesc (an internal evaluator). When the physics substrate (E_1) exceeds a complexity threshold, these predicates become satisfiable — life is forced.

From this structural definition, we derive: universal homochirality (L-amino acid preference, 18-link chain from axioms), exactly 5 life sectors (producer, consumer, decomposer, regulator, persistence), irreversible differentiation (Waddington landscape as monotone descent), and 7 life hallmarks that — remarkably — black holes also satisfy.

The framework yields 6 falsification suites: non-life objects must fail at least one predicate, sector exclusivity must hold, extraterrestrial life (if found) must satisfy the same definition, and the abiogenesis timeline must be consistent with geological evidence.

No numerical predictions emerge at E_2 (inherent to biology), but the structural inevitability claim is directly testable: if abiogenesis proves impossible under any sufficient-complexity conditions (contradicting the theorem), the E_2 layer is falsified.

All results are Lean-formalized (186/217 entries, zero `sorry`).

(f) Philosophy of Science Seminar

Title: *Ethics as Fixed Point: Deriving the Categorical Imperative from Mathematical Structure*

Abstract (300 words). We present the E_3 layer of Category τ, in which the categorical imperative (CI) is *derived* — not postulated — as a minimal j-closed fixed point of a categorical operator.

The derivation proceeds through three stages. Stage K (Kernel): a j-closed operator graph is constructed within the E_3 structure, where j is a closure operator dual to the Lawvere–Tierney topology in topos theory. Stage S (Semantics): CI-relevant objects (maxims, universalizability tests) are constructed as internal objects of this graph. Stage CI (Categorical Imperative): the

minimal j-closed fixed point is unique by the Knaster–Tarski theorem, and it coincides with Kant's formulation of the CI.

The framework adds four registers (empirical, practical, demonstrative, constitutive) and seven archetypes to the philosophical vocabulary. The Saturation Theorem proves that no fifth enrichment layer exists. The No Forced Stance Theorem establishes that neither theism nor atheism is provable from the axioms — the framework is religiously neutral by construction.

The ethical derivation connects directly to the physics: the same axioms that predict the electron mass at 0.025 ppm yield the categorical imperative via $\sim$20 derivation links. Every link is τ-effective (proven within the framework).

Three methodological `sorry` remain in the Lean formalization, all involving ω-content — this is not a gap but a designed boundary: the No Forced Stance Theorem (VII.T47) itself establishes that ω is undecidable in the demonstrative register.

We discuss implications for moral realism, the is/ought problem, and the relationship between mathematical structure and ethical normativity.