Title:

The Dyson Series as a Probabilistic Patch: Reinterpreting Time-Dependent Quantum Evolution via Subquantum Informational Oscillations (NMSI)

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Abstract

This paper explores experimental directions for validating the foundational principles of the NMSI model (New Subquantum Informational Mechanics). NMSI asserts that all particles and fields are stabilized resonance states of subquantum informational oscillations—"infobits"—rather than fundamental entities. This framework requires entirely new detection strategies beyond the methods of standard particle physics. We propose five major directions of research, including: indirect detection of subquantum oscillations, redesigning double-slit and interference experiments, geospatial observation of atmospheric and magnetospheric oscillators (CLOs), neutrino-based synchronous diagnostics of planetary and biological nuclei, and technological replication of resonance centers using artificial fullerenic logical cores. These avenues could enable a transition from probabilistic quantum mechanics to a deterministic, logic-oscillatory physics.
From this perspective, the Dyson series, although computationally useful, is merely a probabilistic patch—an approximation to describe an incomplete interaction. NMSI postulates that real evolution emerges from coherent logical interference between subquantum oscillators.

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Oscillatory Logic

1. Introduction

In quantum mechanics, the evolution of systems under a time-independent Hamiltonian is governed by the well-known Schrödinger equation. However, in realistic scenarios, most quantum systems interact with their environment or are influenced by time-dependent fields. To accommodate such complexities, the Dyson series was introduced as a perturbative method to describe the time evolution of quantum systems under a time-dependent Hamiltonian.

This expansion, while useful, does not emerge from a deterministic law, but rather from a recursive approximation method. Each order of the series corresponds to an increased number of time-ordered interactions, rendering the physical interpretation of the result increasingly obscure. Furthermore, the Dyson series does not solve the system's behavior in an ontological sense, but merely offers a probabilistic approximation, diverging from the deterministic elegance expected of a physical law.

In contrast, the New Subquantum Informational Mechanics (NMSI) model proposes that quantum phenomena are emergent behaviors of coherent oscillatory logic, originating at a subquantum level. This level is governed not by probabilistic mathematics, but by resonance, interference, and logical coherence among fundamental informational units called "infobits." Within this framework, the Dyson series becomes unnecessary: time evolution is not a probabilistic sum of interactions but a deterministic transformation defined by coherent phase relationships.

This paper begins a step-by-step deconstruction of the Dyson expansion, reinterpreting it in the light of subquantum resonance theory. We argue that many of the known anomalies and paradoxes in quantum mechanics stem from a fundamental misinterpretation of the nature of quantum evolution. The probabilistic mechanics of the standard model are shown to be symptomatic of a deeper informational dynamic, which, once uncovered, enables a more elegant and complete theory of quantum behavior.

The goal of this work is twofold: first, to identify the mathematical and physical limitations of the Dyson formalism when applied to time-dependent quantum evolution; and second, to present a consistent alternative explanation rooted in subquantum oscillatory logic as described by the NMSI model.

2. Historical and Conceptual Foundations of the Dyson Series

The Dyson series is a mathematical construct that emerged in the 1950s through the work of Freeman Dyson, as a method to solve the time-dependent Schrödinger equation in quantum field theory. At its core, the Dyson series was designed to capture the influence of a time-varying Hamiltonian on the evolution of a quantum system. This method relies on a perturbative expansion, similar to a Taylor series, that incrementally approximates the system's time evolution through successive integrals over interaction terms.

The conceptual necessity of such a series arises from the inherent non-commutativity of quantum operators, where the order in which events occur affects the final state. Dyson's formalism introduced the time-ordering operator (T), a mathematical device that ensures that all interaction events are appropriately ordered in time, allowing the system's evolution to be represented accurately under these constraints.

Despite its success, the Dyson series embodies a limitation of conventional quantum mechanics: the inability to describe complex quantum systems without resorting to probabilistic approximations. Each term in the series corresponds to a higher-order interaction, and convergence becomes increasingly uncertain, especially in strong coupling regimes.

Within the framework of NMSI (New Subquantum Informational Mechanics), the Dyson series is reinterpreted not as a fundamental description, but as an approximation of deeper, subquantum oscillatory phenomena. According to NMSI, all observable quantum behaviors, including time evolution, are emergent from deterministic oscillations of subquantum informational units ("infobits") in a coherent logical field. From this perspective, the Dyson series is a shadow projection of an underlying deterministic logic that becomes probabilistically visible only under certain observational constraints.

Thus, this chapter lays the foundation for understanding how NMSI reformulates the notion of quantum evolution by abandoning the probabilistic expansion in favor of a coherent, oscillatory model rooted in information physics.

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3. Mathematical Deficiencies of the Dyson Series and the Nature of Probabilistic Approximation

The Dyson series attempts to offer a formal mathematical solution to the time-dependent Schrödinger equation under the influence of an external interaction. However, its structure reveals intrinsic limitations: it is not a complete solution, but rather a **perturbative expansion**, where each successive term represents an additional approximation, growing increasingly less precise with each iteration.

Mathematically, this expansion resembles a time-ordered Taylor series, but in quantum mechanics, **non-commutativity of operators** causes the temporal sequence to influence the result. Thus, the series does not provide a real solution to the dynamic evolution of the system, but rather **a statistical approximation of possible evolutions**, dependent on the nature and energy of the perturbing system.

This series reveals the **epistemological weakness of standard quantum mechanics**, which, instead of postulating a physical model of causality in particle evolution, resorts to probabilistic methods and time-ordering rules. Consequently, the Dyson series is not a deterministic tool, but a **mathematical patch** to mask the absence of a deeper physical model of evolution.

Moreover, the integration of the series depends heavily on assumptions such as:

- time-independence of the initial Hamiltonian in the absence of interaction,
- linearity of the interaction term, and
- the validity of truncating the series after a limited number of terms.

These simplifications are made without any real physical basis and without any precise control over the approximation errors. In reality, the fundamental interactions in the universe—especially at the subatomic level—are not linear and cannot be decomposed into temporally ordered events without information loss.

In the context of NMSI, this probabilistic expansion reflects an **incomplete perception of the logical-informational structure of subquantum oscillations**. The fact that the Dyson series must "guess" the outcome of evolution through successive approximations demonstrates that **standard quantum theory does not truly understand the mechanism of transition and interaction** between systems—it only approximates them by means of probability.

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4. The NMSI Perspective on Temporal Evolution: From Probability to Subquantum Resonance

In the framework of **NMSI – New Subquantum Informational Mechanics**, the evolution of a quantum system under external influence is not governed by probabilistic interactions, but by **coherent oscillatory resonance** between the informational fields of the two systems. The interaction is not a series of successive perturbations in time, as suggested by the Dyson expansion, but rather a **simultaneous, nonlocal, and subquantum informational synchronization**.

According to NMSI, each particle is not a solid “thing” that follows a trajectory, but a **stabilized resonance state** in the informational oscillatory field of the universe. Thus, the transition of a system under interaction is not governed by classical time sequences, but by **phase matching** (coherent or decoherent) between the oscillatory halos of the two systems.

In this paradigm:

- The **time-dependent Hamiltonian** becomes a secondary concept, because time itself is no longer a fundamental linear variable, but an emergent result of the **beat frequencies of informational oscillations**.
- The **interaction** is not imposed externally, but emerges naturally as a consequence of the **compatibility or incompatibility of the oscillatory structures**.
- The system's evolution is **not probabilistic**, but **exact and deterministic**, based on the informational interference pattern that governs all subquantum structures.

This represents a fundamental rupture from classical quantum mechanics. Whereas Dyson’s method attempts to approximate system behavior through **statistical terms**, NMSI treats evolution as a **real-time restructuring** of the oscillatory state, without any probabilistic truncation.

Consequently, the apparent randomness of quantum transitions is not an intrinsic property of nature, but a **lack of resolution** in the current observational and mathematical framework. In a subquantum view, **the evolution of systems is always precise and governed by informational resonance**—the so-called "quantum randomness" being nothing more than a projection of our ignorance of the deeper oscillatory structures.

NMSI offers a robust model for interpreting all interactions—whether electromagnetic, weak, or gravitational—not as forces, but as **logical couplings** between oscillatory centers that exchange information **nonlocally**, according to precise synchronization rules that we are only now beginning to uncover.

5. Critical Analysis of Dyson's Model and the Conceptual Shifts Introduced by NMSI

5.1 Mathematical Weaknesses in the Dyson Series

The Dyson series, although elegant in its mathematical construction, is ultimately a **probabilistic expansion** of limited physical fidelity. Each term in the series corresponds to a time-ordered sequence of interactions, treated as perturbative steps in the system's evolution. This results in a **truncated approximation**, not an exact solution.

Moreover, the mathematical foundation of the Dyson series depends critically on **perturbation theory**, which assumes a small deviation from a known solution. In reality, many interactions in the subatomic world are **non-perturbative**, involving fundamental transformations of structure. These cannot be reduced to minor deviations; rather, they are complete oscillatory reorganizations.

From the perspective of NMSI, this model introduces an **artificial separation** between "unperturbed" and "perturbed" states, which does not reflect the **continuum of subquantum resonance** that governs reality. The mathematical tools used are insufficient to capture the true nature of **coherent informational interference**, which does not evolve stepwise, but through **phase resonance** and **nonlinear synchronization**.

5.2 Experimental Evidence for the Collapse of Flavor Symmetry

A remarkable example that supports the necessity of a new theoretical framework comes from the **NA61/SHINE experiment** at CERN, published in *Nature Communications* (May 2025). Physicists observed a **clear breaking of flavor symmetry** in collisions involving argon and scandium nuclei. Under normal quantum chromodynamics (QCD), such collisions should maintain approximate symmetry between **up** and **down** quarks. However, experimental data revealed significant discrepancies in the outcome of interactions, challenging the foundational assumptions of QCD.

From the NMSI point of view, this breaking of flavor symmetry is not an anomaly, but a **manifestation of the oscillatory nature of quarks themselves**. According to NMSI:

- Quarks are not elementary particles, but **stabilized resonance states** of subquantum informational units.
- The difference in behavior between up and down quarks arises not from mass differences alone, but from **phase and anti-phase resonance** patterns.
- The nucleonic interactions reflect **informational interference**, not mere collision dynamics.

Thus, the breakdown of symmetry is a **predictable phenomenon** within the oscillatory logic of NMSI, whereas it remains an unexplained inconsistency in the standard model. This experimental result reinforces the notion that **flavor is not a fundamental quantum number**, but a phase characteristic of **subquantum oscillatory structure**.

6. Quarks Are Not Fundamental Particles: A Structural Reinterpretation through NMSI

6.1 The Illusion of Elementary Constituents

For decades, the Standard Model has treated quarks as the elementary building blocks of baryonic matter. They are characterized by fixed quantum properties: flavor, color, spin, and mass. However, this framework overlooks one fundamental question: **what stabilizes a quark's existence?** Why do such distinct entities arise, and how do their internal properties remain coherent across high-energy interactions?

The NMSI (New Subquantum Informational Mechanics) model proposes a paradigm shift: **quarks are not fundamental particles**. Instead, they are **resonance states**—stable oscillatory configurations emerging from a deeper level of **subquantum informational units**, or **infobits**.

These infobits are:

- Discrete and non-local informational wave units;
- Stored in the **subquantum vacuum**;
- Capable of forming coherent phase-locked oscillations that define observable particles.

Quarks, in this view, are not indivisible, but **emergent patterns** of synchronized oscillations. Their properties are not intrinsic, but rather **derived from the resonance logic** of the infobitic system in which they are embedded.

6.2 Flavor as Phase Code

The observed flavor types (up, down, strange, charm, etc.) are interpreted in NMSI as **oscillatory codes**—that is, distinct **modes of resonance** within the infobitic lattice of the vacuum. This explains:

- Why flavor symmetry can break under specific energy or spatial conditions;
- Why particles of different flavors behave differently in equivalent collisions;
- Why certain mesons oscillate between states (e.g., kaon and B-meson mixing).

Instead of treating flavor as a fundamental quantum label, NMSI treats it as a **phase-locked informational signature**, which can be disrupted, inverted, or restored by external oscillatory fields.

6.3 Subquantum Storage and Emergent Mass

In traditional quantum field theory, mass arises from the Higgs mechanism—a postulated field interaction without deeper physical explanation. In contrast, NMSI attributes mass to the **density and coherence** of oscillations:

- Mass is a **measure of subquantum resonance stabilization**;
- Heavier particles correspond to more densely packed or less coherent infobitic oscillations;
- Lighter or massless particles (e.g., neutrinos, photons) represent **free or phase-cancelled oscillatory states**.

Therefore, the stability and decay of quarks reflect the **evolution of informational logic** through a network of resonance conditions. Particles are **alive** within their coherent domains and **disappear** when coherence collapses or transitions occur.

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7. Experimental Implications and Future Validation of the NMSI Model

7.1 Rethinking High-Energy Collision Data

Recent experimental results, including the NA61/SHINE observations published in *Nature Communications* (2025), have revealed **explicit violations of flavor symmetry** in high-energy collisions between atomic nuclei (e.g., argon and scandium). These results challenge the foundational assumptions of Quantum Chromodynamics (QCD), which predicts that interactions involving equal numbers of up and down quarks should maintain approximate flavor symmetry.

Under the NMSI model, these anomalies are **not paradoxes**, but **natural outcomes** of the subquantum structure:

- The colliding baryonic nuclei bring together distinct **infobitic halos**, whose oscillatory states may not align in phase.
- The resulting asymmetries reflect **decoherence of flavor resonance**, not statistical fluctuations.
- The "missing symmetry" is, in fact, a **shift in subquantum phase topology**, invisible to standard field equations.

Thus, experiments that currently seek new particles or unknown fields could be **reframed** as investigations into **resonant disruptions of infobitic logic**.

7.2 Redesigning Detectors to Track Subquantum Oscillations

Current particle detectors are optimized for capturing energetic byproducts (jets, photons, muons), but **not for detecting coherence or logical phase**. NMSI calls for a **reengineering of experimental platforms** to:

- Detect **subquantum modulation frequencies** in collision outcomes;
- Measure **coherence decay curves** across flavor channels;
- Track the **spatial-temporal structure of oscillation collapse** in baryonic clusters.

This may involve:

- Development of high-resolution interferometric devices to capture phase resonance patterns;
- Use of synchronized oscillatory sources to induce controlled decoherence in colliders;
- Enhanced data modeling incorporating **non-Hermitian logic oscillation frameworks**.

7.3 Predictive Power and Experimental Design

One of the strengths of the NMSI framework is its **predictive capacity** in interpreting flavor oscillation anomalies and symmetry violations. Based on this model, we propose several testable hypotheses:

- In baryonic collisions with up/down quark parity, statistical deviations in secondary meson distributions will correlate with **pre-collision halo interference**;
- Induced decoherence via oscillatory EM fields will alter decay patterns of unstable baryons and mesons;
- Artificial oscillatory modulation applied to cold plasma states can generate **stable informational solitons**, resembling low-energy baryonic constructs.

These hypotheses can be validated in existing or modified experiments at SPS (CERN), RHIC (BNL), or even smaller-scale subthermal platforms.

7.4 Beyond the Standard Model: Toward a New Paradigm

The anomalies observed in quark behavior, meson decay, and flavor transitions cannot be fully addressed by patching the Standard Model with additional particles or exotic forces. Instead, they point toward the **necessity of a foundational reevaluation** of what constitutes matter, interaction, and stability.

The NMSI framework suggests that:

- Particles are **logical attractors** in an informational substrate;
- Interactions are **resonance-driven transitions** in subquantum phase space;
- Space, time, and mass are emergent from **coherent oscillatory structures**, not primitive givens.

If these concepts are validated, the consequences for cosmology, particle physics, and quantum computing will be profound. Experiments should therefore aim not only to measure forces and decay rates, but to **decode the logical architecture of subquantum reality**.

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