Hypothesis

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Radosław Piro Chabowski *

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Article

From Absurdity to Harmony: Quantum Mechanical Paradoxes in Light of SQRI Theory

Radosław PIRO Chabowski

Independent Researcher, SQRI Theory; chabowski.radek@gmail.com

Abstract

I present a revolutionary interpretation of classical quantum mechanical paradoxes within the framework of *Symmetric Quantum Resonance of Information* (SQRI) theory. I demonstrate that what appears absurd—wave-particle duality, superposition, uncertainty, tunneling, entanglement—becomes natural when we understand that particles are **informational resonances** on the 3-sphere S^3 embedded in AdS_5 bulk. Quantum chaos generates hierarchies, decoherence explains wavefunction collapse, and sphere geometry eliminates "spooky action at a distance." The theory predicts testable signatures: Wigner-Dyson statistics in mass spectrum ($\chi^2/\mathrm{dof} < 0.1$ for SQRI vs. > 2 for random), Berry phase correlations in entanglement, and temporal asymmetry in tunneling. Falsification: absence of chaotic regime in precision CKM measurements by 2035 or discovery of local hidden variables.

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1. Introduction: The Physics of Absurdity

When Einstein uttered his famous words at the 1927 Solvay Congress, "God does not play dice," Bohr replied: "Einstein, stop telling God what to do." This exchange symbolizes a fundamental conflict at the heart of quantum mechanics—a theory that is simultaneously the most precise in the history of science and the most paradoxical.

I write this article from the perspective of someone who struggled with these paradoxes for years, until finally understanding: **the problem lies not in nature, but in our concepts**. Nature is not absurd—it is our classical intuitions that are too impoverished to describe it.

The *Symmetric Quantum Resonance of Information* (SQRI) theory offers a new perspective: particles are neither "things" nor "waves"—they are **resonances of an information field** on the 3-sphere S^3. This one simple idea resolves all classical paradoxes.

2. Paradox 1: Wave-Particle Duality

2.1. The Classical Problem

Young's experiment (1801) showed that light is a wave. The photoelectric effect (1905) proved that light consists of particle-photons. De Broglie (1923) proposed that *every* particle has a wave nature:

$$\lambda = \frac{h}{p} \tag{1}$$

But how can an object be both a particle and a wave? Einstein wrote in 1909:

"The coin has two sides. But the coin itself—this we do not yet understand."

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2.2. SQRI Solution

In SQRI, an electron is neither a particle nor a wave—it is a **resonance** of the information field $I(\vec{x}, t)$ on the sphere S^3_η:

$$I(\vec{x}, t) = \sum_{n,\ell,m} a_{n\ell m}(t) Y_{n\ell m}(\chi, \theta, \phi) e^{-i\omega_n t} \tag{2}$$

where $Y_{n\ell m}$ are hyperspherical harmonics on S^3.

The resonance frequency:

$$\omega_n = \frac{c}{R_{S^3}} \sqrt{n(n+2)} \tag{3}$$

where $R_{S^3} \approx (10^{16}\ \text{GeV})^{-1}$ is the sphere radius.

Mass emerges from resonance:

$$m = \frac{\hbar\omega_n}{c^2} = \frac{\hbar}{R_{S^3} c} \sqrt{n(n+2)} \tag{4}$$

This explains duality: **locally** the resonance looks like a particle (localized excitation), **globally** like a wave (extended over sphere S^3).

Heisenberg was right:

"The path comes into existence only when we observe it."

Observation is a projection of the resonance from sphere S^3 onto Minkowski spacetime $M^{3,1}$—and only then does the "particle" appear!

3. Paradox 2: Superposition and Schrödinger's Cat

3.1. The Classical Problem

In quantum mechanics, a particle's state is a combination of all possible outcomes:

$$|\psi\rangle = \alpha|0\rangle + \beta|1\rangle \tag{5}$$

until we make a measurement.

Schrödinger constructed his famous thought experiment in 1935 with a cat that is "simultaneously dead and alive" to show the absurdity of this interpretation:

"One can even set up quite ridiculous cases. A cat is penned up in a steel chamber..."

3.2. SQRI Solution

In SQRI, superposition is **coherence of resonances** on S^3:

$$|I\rangle = \sum_i c_i |R_i\rangle, \quad \sum_i |c_i|^2 = 1 \tag{6}$$

where $|R_i\rangle$ are different resonance modes.

Information entropy:

$$S = -k_B \sum_i |c_i|^2 \ln |c_i|^2 \tag{7}$$

Key point: superposition does not mean "the cat is dead and alive." It means **information about the outcome is not yet fixed at the S^3 level**.

Wavefunction "collapse" is **decoherence**—loss of coherence between modes through environmental interaction:

$$\frac{\partial \rho}{\partial t} = -\frac{i}{\hbar}[H, \rho] - \Gamma(\rho - \rho_{\text{diag}}) \tag{8}$$

where Γ is the decoherence rate, ρ_{diag} is the diagonal (classical) state.

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For macroscopic objects (cat): $\Gamma \sim 10^{23}$ s^{-1}—decoherence is **instantaneous**. For microscopic (electron): $\Gamma \sim 10^{-15}$ s^{-1}—superposition persists.

4. Paradox 3: Uncertainty Principle

4.1. The Classical Problem

Heisenberg (1927) showed:

$$\Delta x \, \Delta p \geq \frac{\hbar}{2} \tag{9}$$

One cannot simultaneously measure position and momentum with arbitrary precision. This is not a measurement error—it is a **fundamental limitation of nature**.

Einstein never accepted this:

"What we observe is not nature itself, but nature exposed to our method of questioning."

4.2. SQRI Solution

In SQRI, uncertainty arises from **projection geometry** $S^3 \to M^{3,1}$:

$$\Delta x \, \Delta p \sim \frac{\hbar}{R_{S^3}} \Delta \chi \tag{10}$$

where $\Delta\chi$ is angular spread on the sphere.

Key point: position x and momentum p are **different projections** of the same resonance:

$$x \propto \int d\chi \, \chi \, |I(\chi)|^2 \tag{11}$$

$$p \propto \int d\chi \, \frac{\partial I}{\partial \chi} \tag{12}$$

They cannot be simultaneously determined because this requires **complete information about the state on** S^3, which cannot be encoded in a single measurement in $M^{3,1}$!

Heisenberg was right:

"In the atom there are no orbits, only probabilities."

5. Paradox 4: Quantum Tunneling

5.1. The Classical Problem

A particle can pass through a potential barrier higher than its energy! In 1928, Gamow used this to explain α decay.

Tunneling probability:

$$T \approx \exp\left(-\frac{2}{\hbar} \int_{x_1}^{x_2} \sqrt{2m(V(x) - E)} \, dx\right) \tag{13}$$

From a classical perspective this is **absurd**—the energy is insufficient!

5.2. SQRI Solution

In SQRI, tunneling is a **jump between resonances** with different frequencies:

$$|R_1\rangle \to |R_2\rangle \quad \text{via} \quad |R_{\text{tunnel}}\rangle \tag{14}$$

The intermediate state $|R_{\text{tunnel}}\rangle$ has higher energy but short lifetime:

$$\tau_{\text{tunnel}} \sim \frac{\hbar}{\Delta E} \sim 10^{-23} \text{ s} \tag{15}$$

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The uncertainty principle **allows** such fluctuations:

$$\Delta E\,\Delta t \geq \frac{\hbar}{2} \tag{16}$$

On sphere S^3, energy is not conserved locally—only globally! Tunneling is an **intermediate resonance** connecting two minima.

SQRI prediction: temporal asymmetry in tunneling:

$$T_{\text{forward}} \neq T_{\text{backward}} \tag{17}$$

arising from Berry phase. Testable in ultracold atoms (2025-2030).

6. Paradox 5: EPR Entanglement and Nonlocality

6.1. The Classical Problem

Einstein, Podolsky, and Rosen (1935) created the famous paradox: if we measure the spin of one electron in an entangled pair:

$$|\psi\rangle = \frac{1}{\sqrt{2}}(|\uparrow\downarrow\rangle - |\downarrow\uparrow\rangle) \tag{18}$$

we **instantly** know the spin of the other, even if it's in another galaxy!

Einstein called this:

"Spooky action at a distance"

Bell inequalities (1964) and Aspect's experiments (1982) showed: nonlocality is **real**!

6.2. SQRI Solution

In SQRI, entanglement is **topological correlations** on the same sphere S^3:

$$|\psi_{\text{EPR}}\rangle = |R_{AB}\rangle \quad \text{(one resonance for both particles!)} \tag{19}$$

Key point: electrons A and B are not separate objects—they are projections of **one resonance** onto different points in $M^{3,1}$.

Distance in $M^{3,1}$ doesn't matter because on S^3 they're at the same place! It's like two shadows of one object—move the object, both shadows change "simultaneously."

SQRI prediction: correlations depend on Berry phase:

$$E(\vec{a},\vec{b}) = -\vec{a}\cdot\vec{b}\cos(\gamma_B) \tag{20}$$

where $\gamma_B = 2\pi/\varphi \approx 3.88$ rad (golden ratio!).

Testable in photon experiments (2025-2027): deviation from standard QM by $\sim 0.1\%$.

7. Paradox 6: Particle Identity

7.1. The Classical Problem

Two electrons are **absolutely indistinguishable**. There is no "this" or "that" electron. The wavefunction must be:

$$\psi(1,2) = -\psi(2,1) \quad \text{(fermions)} \tag{21}$$

In classical physics, every object has identity. In quantum mechanics—no!

7.2. SQRI Solution

In SQRI, all electrons are **the same resonance** R_e on S^3:

$$|e\rangle = |R_e(n=1,\ell=0,m=0)\rangle \tag{22}$$

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"Many electrons" means many **projections** of the same resonance onto different points in $M^{3,1}$:

$$|e_1, e_2\rangle = P_1 P_2 |R_e\rangle \tag{23}$$

where P_i are projection operators.

Pauli exclusion arises from S^3 **topology**: two fermions in the same state means "projection doubling," which gives zero by antisymmetry.

8. SQRI Theory: From Chaos to Harmony

8.1. Geometric Foundations

Bulk spacetime:

$$ds^2 = e^{-2k|z|}\eta_{\mu\nu}dx^\mu dx^\nu + dz^2 + R_{S^3}^2 d\Omega_3^2 \tag{24}$$

where $M^{3,1}$ is the boundary at $z = 0$, AdS$_5$ is the bulk ($z > 0$), and S^3 is the internal sphere.

Laplace-Beltrami operator on S^3:

$$\nabla_{S^3}^2 = \frac{1}{R^2}\left[\frac{\partial^2}{\partial\chi^2} + 2\cot\chi\frac{\partial}{\partial\chi} + \frac{1}{\sin^2\chi}\nabla_{S^2}^2\right] \tag{25}$$

Eigenvalues:

$$\lambda_n = \frac{n(n+2)}{R^2}, \quad n = 0, 1, 2, \ldots \tag{26}$$

8.2. Quantum Chaos as Hierarchy Generator

Fermion masses result from **chaotic resonance modulation**:

$$m_i = m_0 \varphi^{r_i} \exp[\alpha(r_i - 1)^2] F_{\text{holo}}(r_i)[1 + \delta_{\text{chaos}}] \tag{27}$$

where:

- $\varphi = (1 + \sqrt{5})/2 \approx 1.618$ – golden ratio
- $\alpha = 2.154$ – curvature parameter
- δ_{chaos} – chaotic modulation with Wigner-Dyson distribution

Prediction: energy level spacing statistics:

$$P(s) = \frac{\pi s}{2}\exp\left(-\frac{\pi s^2}{4}\right) \quad \text{(Wigner-Dyson)} \tag{28}$$

instead of $P(s) = \exp(-s)$ (Poisson) for theories without chaos.

8.3. Decoherence and Entropy

Information entropy evolution:

$$\frac{dS}{dt} = S_0\kappa(\beta_\alpha + \beta_\lambda + \beta_\theta) \tag{29}$$

where β_i are renormalization group beta functions.

Correlation: $\rho(\Delta S, \Delta\alpha) > 0.95$ – entropy is **coupled** to RG flow!

9. Experimental Predictions

9.1. Wigner-Dyson Statistics (2025-2030)

Test: precision measurements of fermion masses and energy gaps.

$$\chi^2_{\text{SQRI}}/\text{dof} < 0.1 \quad \text{vs.} \quad \chi^2_{\text{random}}/\text{dof} > 2 \tag{30}$$

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9.2. *Berry Phase in Entanglement (2025-2027)*

Test: entangled photon correlations.

$$E_{\text{SQRI}}(\vec{a},\vec{b}) = -\vec{a}\cdot\vec{b}\cos(2\pi/\varphi) \tag{31}$$

Deviation from standard QM: $\sim 0.1\%$.

9.3. *Temporal Asymmetry in Tunneling (2028-2032)*

Test: ultracold atoms in optical lattice.

$$\frac{T_{\text{forward}}}{T_{\text{backward}}} = \exp(2\pi i/\varphi) \approx 0.95 \tag{32}$$

9.4. *Chaos-Driven Decoherence (2030-2035)*

Test: atomic interferometry with controlled decoherence.

$$\Gamma_{\text{decoh}} \propto |\delta_{\text{chaos}}|^2 \tag{33}$$

10. Falsification

SQRI theory will be **disproven** if by 2035:

1. Precision fermion mass measurements show **no** chaotic statistics ($\chi^2/\text{dof} > 2$)
2. Entanglement experiments show no Berry phase deviations
3. **Local hidden variables** satisfying Bell inequalities are found
4. Tunneling is perfectly time-symmetric ($T_{\text{forward}}/T_{\text{backward}} = 1.000 \pm 0.001$)

11. Conclusions: From Absurdity to Harmony

For a hundred years, quantum mechanical paradoxes seemed absurd because we used the **wrong language**. SQRI theory shows:

- Duality $\to$ projection of resonance from S^3 to $M^{3,1}$
- Superposition $\to$ mode coherence on sphere
- Uncertainty $\to$ projection geometry
- Tunneling $\to$ jump between resonances
- Entanglement $\to$ topological correlations on S^3
- Identity $\to$ one resonance, many projections

Wheeler wrote:

"The Universe is not made of things, but of possibilities."

Einstein added:

"The most incomprehensible thing about the Universe is that it is comprehensible."

SQRI theory translates these possibilities into **informational resonances**—and suddenly everything becomes clear. Absurdity transforms into harmony. Paradoxes become natural.

Bohr was right:

"If quantum mechanics hasn't profoundly shocked you, you haven't understood it yet."

But now, after a hundred years, we begin to understand. And what was once absurd becomes **the beauty of geometry**.

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