ERIЯƎ Simulation — Rotational Phase Coherence and the Photoelectric Effect

Abstract

This article presents a simulation based on the ERIЯƎ theoretical model to reinterpret the photoelectric effect — one of the foundational phenomena in quantum physics — using the geometry of rotational coherence. Instead of modeling the interaction as a probabilistic photon-electron collision, the simulation uses rotational phase transitions and coupling as the core mechanism. Through this perspective, the Planck constant emerges not as a fixed universal value, but as a measurable projection of a deeper coherent structure. The experiment models transitions, energy thresholds, and predictions of electron emission under various coherent and incoherent scenarios.

Context and Theoretical Basis

According to **Expansion 17** of the ERIЯƎ framework, the emission of energy (such as a photon) is not treated as a discrete or random quantum jump, but rather as a **geometric transition between coherent rotational states**. The model links energy to the product:

$$E = h \cdot \nu \cdot \Gamma$$

Where:

- ν is the rotational or wave frequency.
- $\Gamma = \cos(\Delta\phi)$ is the rotational coherence factor derived from the angular phase difference.
- h emerges from the slope of the E vs ν graph during coherent transitions.

The experiment tests the emission condition in a cesium-like material using phase transitions $m_i \rightarrow m_f$, with energy thresholds and simulated coherence constraints.

Simulation Setup

- **Base State:** `z_base = mpc(1, 1)` — This complex number represents a symmetric and coherent initial condition in the ERIЯƎ rotational domain. It encodes equal contributions from real and imaginary components of the initial state, interpreted geometrically as a balanced phase angle (π/4 rad) on the complex unit circle. While the deeper justification of this initialization is elaborated in a forthcoming expansion (see ERIЯƎ Expansion 24), this choice ensures that all rotational components start from a coherent baseline aligned with the intrinsic geometry of the theory. state.
- **Test Material:** Cesium, with a work function $\phi = 1.94$ eV.
- **Transitions Simulated:** $m = 2 \rightarrow 1, 3 \rightarrow 1, 4 \rightarrow 1, 5 \rightarrow 1$.
- **Light Frequencies:** Ranges from visible red (~640 nm) to ultraviolet C (~250 nm).

The ERIRE class is used to simulate the exponential rotational evolution for each quantum-like index m, and derive phase difference $\Delta\phi$, energy E, and rotational projection Γ.

> **Note on the Initial Complex State** `z_base = mpc(1, 1)`
> This initial condition represents a symmetrical phase angle of 45° (π/4) in the complex plane, placing the system in a balanced rotational starting point with equal contributions from real and imaginary components. It serves as a maximally coherent and non-preferential state. A full geometric justification will be provided in Expansion 24.

Results Summary

The model accurately predicts when **photoemission occurs**, given both the light frequency and the transition depth (Δφ). Key insights:

- For **visible light**, transitions fail to reach the energy threshold of cesium → **no electron emitted**.
- Under **UV-A (320 nm)**, the model predicts emission for higher transitions (m = 3+), with kinetic energy aligning closely with Einstein's law $E_{kin} = E_{abs} - \phi$. While the model aligns numerically with Einstein's photoelectric relation $E_k = h\nu - \phi$, it is important to clarify that within the ERIЯƎ framework, neither Planck's constant h nor the work function ϕ are treated as immutable

constants of nature. Instead, they emerge from coherent rotational states of the medium. The apparent constancy observed in traditional physics reflects the high degree of coherence present in most regions of the physical universe. However, under extreme conditions or geometrically distinct domains, these quantities may vary subtly, representing the dynamic coherence of the vacuum itself.

- The factor Γ consistently modulates the effective energy, providing a geometric origin for energy projection loss.
- The simulation also estimates the **Planck constant** by computing $\Delta E/\nu$, yielding $h_{sim} \approx 2.16 \times 10^{-34}$ J·s, demonstrating the emergence of h from within the model structure.

> **Planck's Constant as a Coherence Emergence**
> While it remains constant in most coherent regimes, this interpretation allows for deviations under altered phase densities or coherence breakdowns. This aligns with the view that "constants" are effective parameters of a dynamically coherent medium.

Graphical Insights

Plots are generated for:

- Phase difference $\Delta\phi$ versus transition m.
- Energy versus frequency $E = h\nu$.
- Estimation of h across transitions.

An additional 3D visualization of the coherence space is proposed in future expansions, to aid in geometric interpretation of Γ.

Discussion and Interpretation

This simulation supports the core proposition of Expansion 17: **quantization is emergent**, not fundamental. The electron is not ejected randomly by a photon, but as a result of **rotational coherence breaking** under frequency stimulation.

- The field's influence is modeled indirectly by rotational transitions.
- The photoelectric threshold is interpreted as the **minimum Δφ projection aligned with external rotational flux**.
- Γ is revealed as a **geometric constraint**, not an empirical fudge factor.

This leads to a broader interpretation of Planck's constant — **not as a fixed law, but as an average projection of coherent evolution**.

> **Reinterpreting Einstein's Equation from First Principles**
> The ERIЯƎ simulation reproduces the threshold behavior described by Einstein's photoelectric equation. However, instead of relying on a postulated quantization of light, it derives energy emission from discrete changes in rotational phase coherence. This provides a deterministic foundation for photon-like behavior based on internal structure transitions rather than probability-based quantization.

Conclusion

This experiment demonstrates a working computational model of the photoelectric effect based on the ERIЯƎ framework. Using only rotational coherence, angular phase projection, and dynamic transitions, the simulation reproduces the observed behavior of electron emission from materials under various light conditions. The agreement with Einstein's photoelectric law and the emergence of h from phase analysis affirm the validity of ERIЯƎ's geometric approach.

Access and Reproducibility

The source code is publicly available:
🔗 **https://github.com/DanBrasilP/ERIRE**

Explore the folder `/python/exp17_efeito_fotoeletrico.py` for the live experiment.
Feel free to test different frequencies, transitions, and material work functions.

Philosophical Reflection

> "The medium is not a dead void; it is a living coherence, where even the slightest resonance sustains the order of the whole."

> "Emission is not an act of chance — it is the echo of broken symmetry."