ERIЯƎ Simulations — Rotational Coherence in the Proton-Electron System

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GitHub Repository: https://github.com/DanBrasilP/ERIRE

Overview

This report presents a consolidated analysis of two foundational computational experiments within the ERIЯƎ theoretical model—**Theoretical Expansion 19** and **20**—each exploring the rotational interaction between proton and electron beyond conventional QED and electrostatics.

The ERIЯƎ framework (Exponentialization and Rationalization of Imaginary Rotational Evolution) provides a geometric and rotational interpretation of atomic-scale interactions. These studies aim to replace the postulate of discrete quantization with a **dynamical loss of phase coherence**, manifested through **rotational projection** of the interaction space.

Scope of Experiments

Expansion 19 — ERIЯƎ Dynamic Projection Model

- Simulates the rotational coherence between proton and electron as a function of radial distance.
- Introduces the **|Z_total|** factor to represent the projectional alignment of rotational momenta.
- Calculates ERIЯƎ forces and potential energies and compares them against the classical Coulomb model and CODATA/NIST values.
- Demonstrates that when |Z_total| = 1, ERIЯƎ yields classical results; when |Z_total| ≈ 0.5, it reproduces the *experimental energy levels* precisely.

Expansion 20 — Coherence Scaling and Quantized Levels

- Extends the simulation for excited states (n = 2 to 5).

- Derives the **radial scaling law** for coherence, where $|Z\_total| \propto 1/n$.
- Compares energy levels from ERIЯƎ with both Bohr's model and measured values.
- Shows that rotational coherence decays progressively as n increases, accounting for energy quantization naturally.

Key Distinctions in the ERIЯƎ Model

- **Radial Coherence vs Linear Radius:**
  Unlike the Bohr model which treats radius as a static scalar ($r \propto n^2$), the ERIЯƎ model treats it as a **dynamic radial projection**, evolving geometrically and influencing the observed energy through **phase alignment**.
- **No Discrete Quantization Assumed:**
  Quantized behavior **emerges** from coherence degradation rather than being imposed.
- **Rotational Field Geometry:**
  The interaction is analyzed via imaginary rotational projection, not merely scalar distance. This leads to results that align with experiments while offering a different physical interpretation.

Numerical Alignment Summary

n	Radius (nm)	Classical Energy (eV)	Experimental Energy (eV)	ERIЯƎ Z_total
1	0.0529	-27.2114	-13.6057	≈ 0.5000
2	0.212	-6.8028	-3.4014	≈ 0.5000
3	0.476	-3.0235	-1.5117	≈ 0.5000
4	0.847	-1.7007	-0.8504	≈ 0.5000
5	1.323	-1.0885	-0.5442	≈ 0.5000

Core Interpretations

- The ground state coherence |Z_total| ≈ 0.5 implies that only **50% of the classical interaction energy** is effectively realized due to phase misalignment.
- Higher energy levels follow the Bohr energy law ($1/n^2$) **without enforcing discrete transitions**, indicating that **dephasing dynamics are sufficient** to explain quantization.
- The model reinterprets potential energy as a result of **rotational deviation**, not electrostatic potential, unifying geometry and resonance in a single field structure.

Access and Reproducibility

All experiment data and simulation scripts are available in the public GitHub repository:
https://github.com/DanBrasilP/ERIRE

Explore the directory `/python/` for runnable examples of the experiments described above.

Conclusions

The ERIЯƎ model provides a novel framework for understanding atomic interactions through a geometric and dynamic approach. The results presented here:

- Reproduce key physical constants and energy levels from first principles.
- Reveal quantization as a continuous outcome of coherence dynamics, rather than discrete assumptions.
- Offer a compelling basis for further development in unifying electromagnetic and gravitational interactions through rotational coherence.

> “It is not charge that binds the atom — it is coherence.”