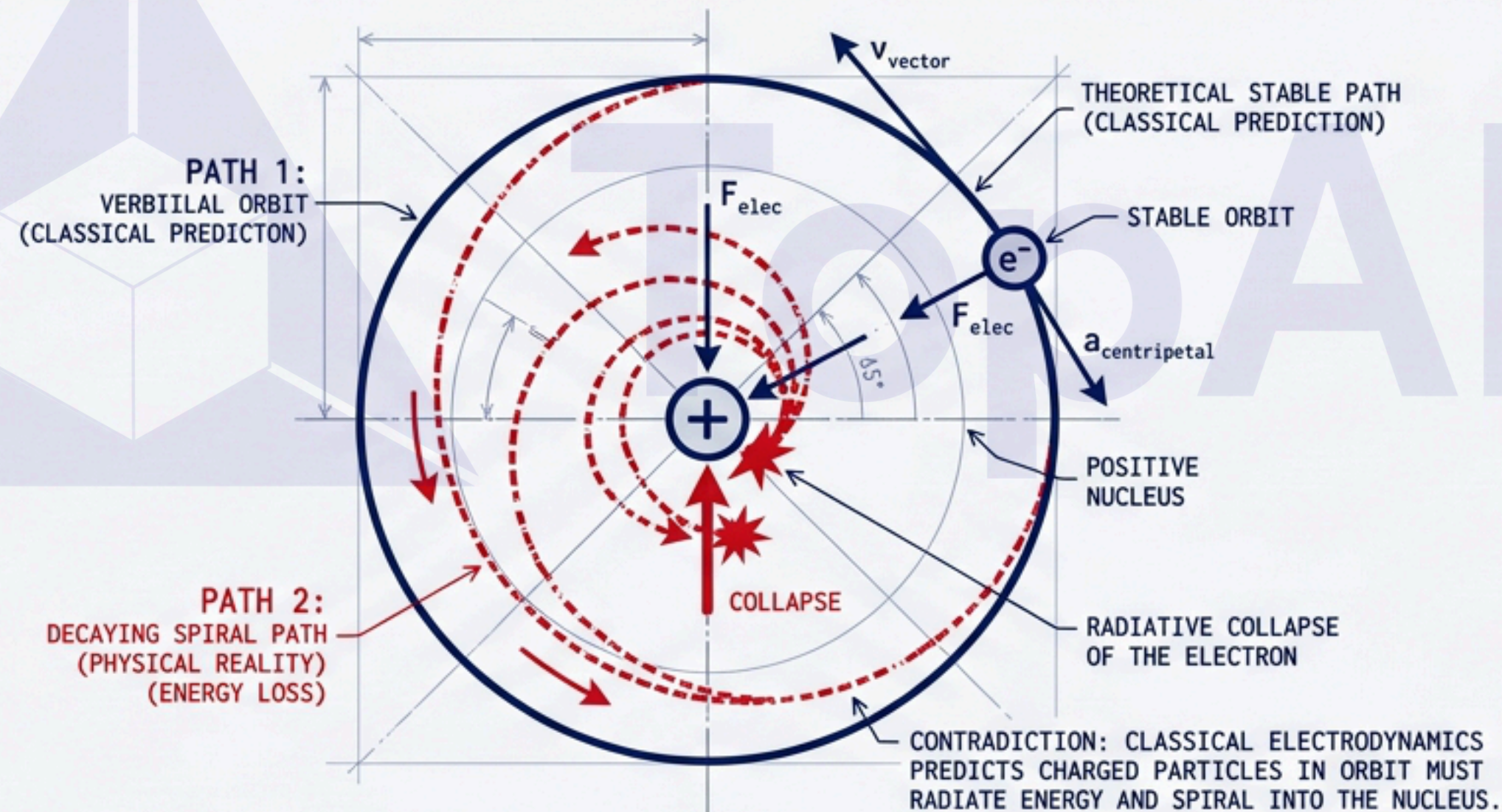


2.2.5 ATOMIC STRUCTURE

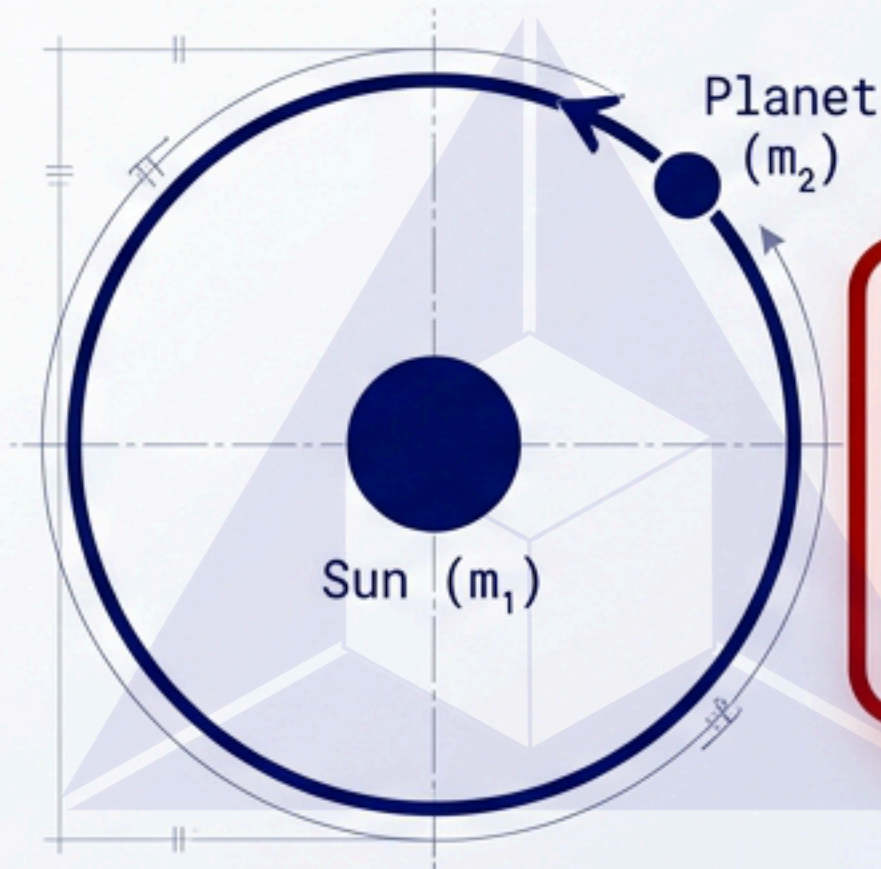
The Breakdown of the Planetary Atom

Why Rutherford's nuclear model contradicts the laws of classical physics and observable reality.



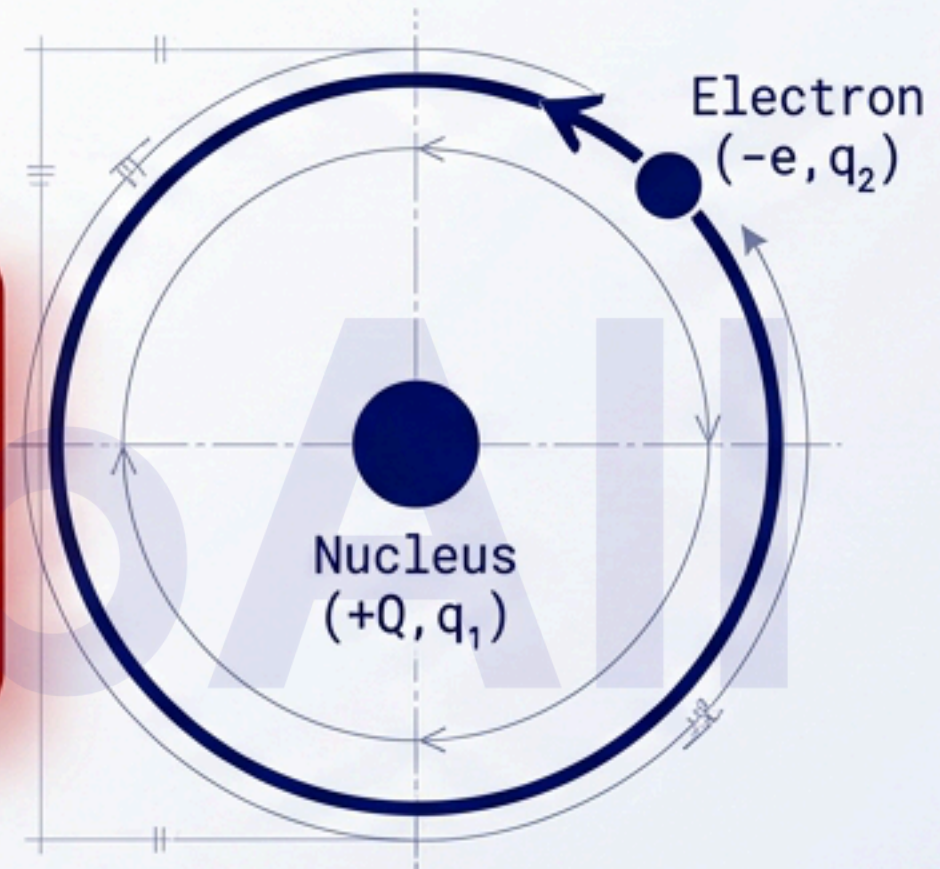
The Mathematical Temptation of the Planetary Model

Macroscopic: The Solar System



- Uncharged masses
- Predictable planetary orbits

Microscopic: The Rutherford Atom



- Charged masses
- Assumed stable circular orbits

Kinematic Reality:
Circular motion at a
constant speed is
continuous acceleration
due to changing direction.

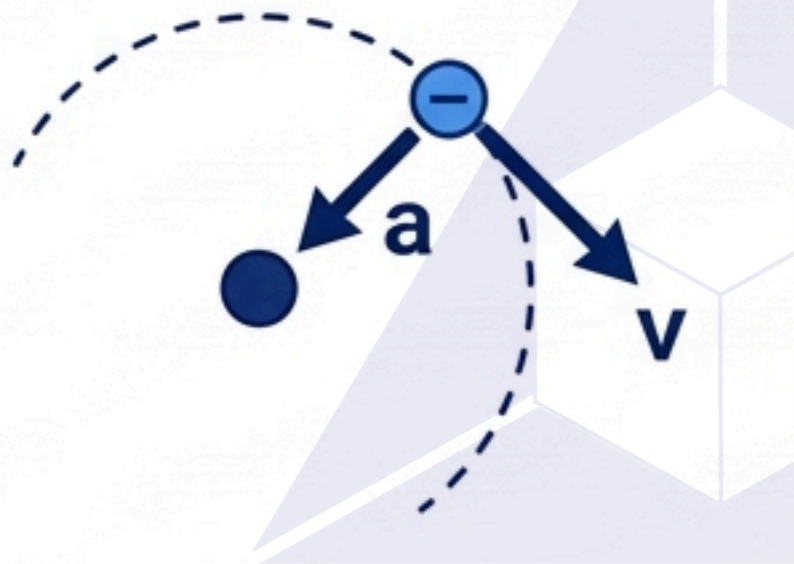


Gravitational Force: $F = G \frac{m_1 m_2}{r^2}$

Electrostatic Coulomb Force: $F = k \frac{q_1 q_2}{r^2}$

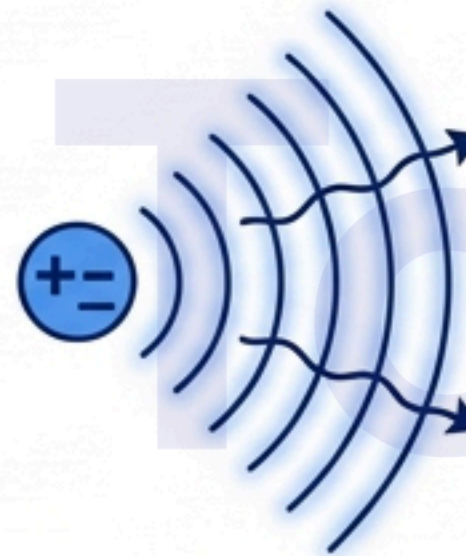
Maxwell's Electromagnetic Trap

The Condition:
Orbiting = Accelerating



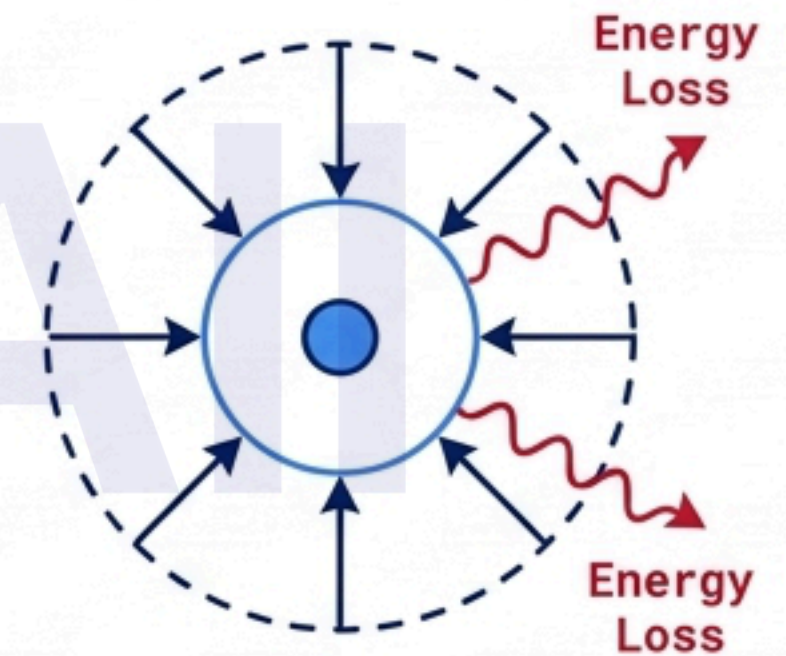
The electron is in constant acceleration to maintain its circular path around the nucleus.

The Classical Law:
Acceleration + Charge
= Radiation



According to Maxwell's electromagnetic theory, any charged particle under acceleration must emit electromagnetic radiation. (Planets do not, as they are uncharged).

The Consequence:
Radiation = Energy Loss



The energy carried away by radiation comes directly from the electron's motion, causing its orbit to shrink.



You've Learned the Theory. Let's Test Them Now.

$$E=mc^2$$



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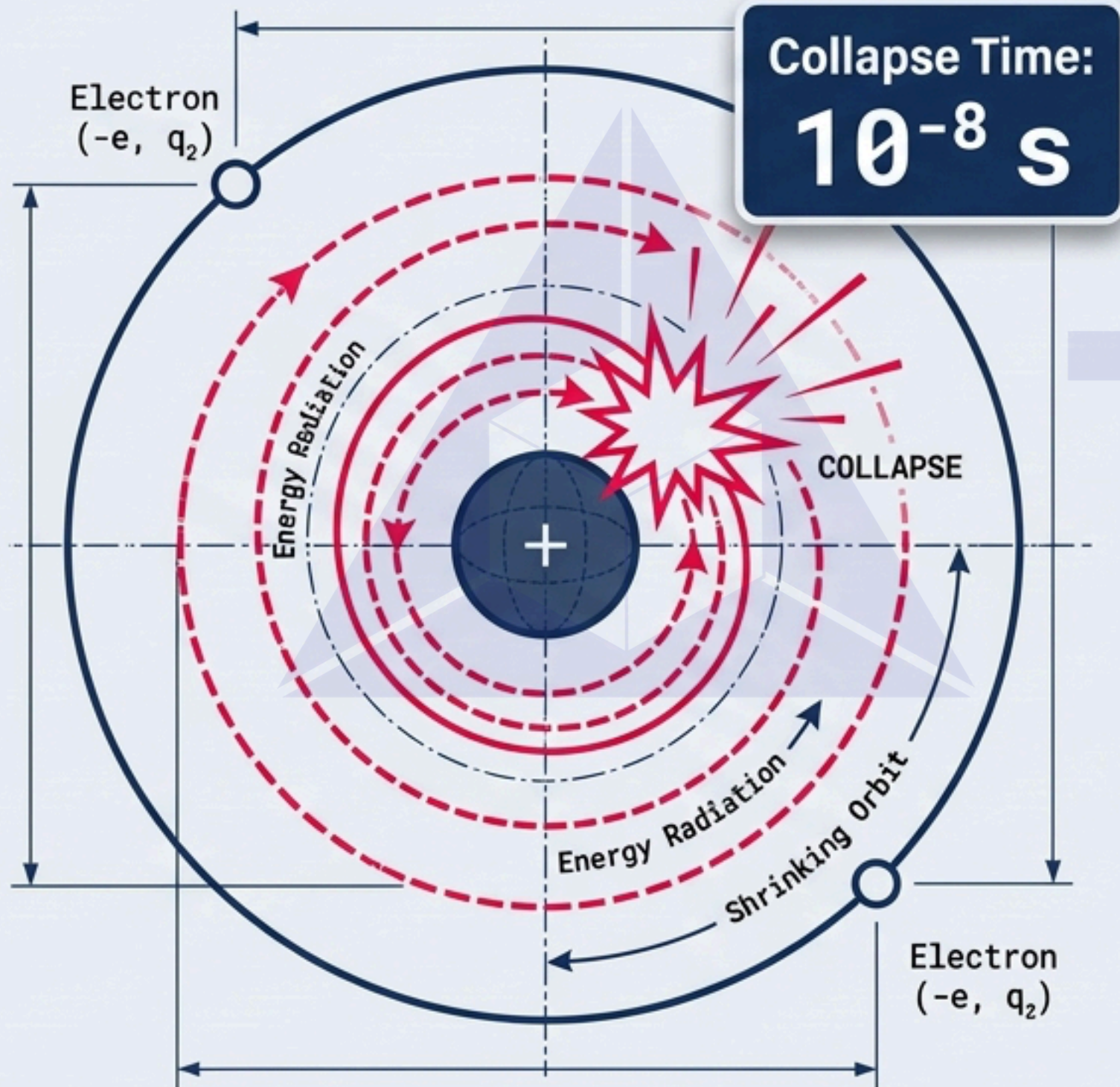
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- » Track Your Performance Smarter



The Inevitable Death Spiral



The Classical Prediction: Shrinking Orbit

As kinetic energy is radiated away, the electron's orbital radius decreases. Calculations show it takes only a fraction of a second to spiral into the nucleus.

The Stationary Alternative?

If electrons were stationary to avoid acceleration, electrostatic forces would immediately pull them into the nucleus (forming a miniature Thomson model).

The Contradiction: Atoms are stable. Matter exists. Therefore, classical mechanics cannot apply to subatomic particles.

Final Recap: The Limits of Rutherford's Atom



Fails to Explain Atomic Stability

Classical electromagnetic theory dictates that an orbiting planetary electron would instantly collapse into the nucleus. The model provides no mechanism for stable orbits.



Fails to Explain Electron Distribution

The model offers zero mathematical framework regarding how electrons are distributed around the nucleus, nor does it define the specific energies associated with them.



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