

EN_4: Einstein-VED: Deterministic Derivation of the Proton and the R_VED Formula

Résumé

Il déduit la masse et le rayon du proton à partir de la condition de confinement des ondes en 3S+T. Toute particule massique possède une fréquence et une longueur d'onde de Compton ($\lambda_C = h/(mc)$).

Pour qu'une onde soit confinée de manière stable, le périmètre doit contenir un nombre exact d'ondes complètes : $L = n\lambda_C$. Pour le

proton, la stabilité en 4 dimensions nécessite $n_{\min} = 4$. Ainsi, le

périmètre est $L_p = 4\lambda_p$ et le rayon est $R_p = 2\lambda_p/\pi = 4\hbar/(m_p c)$. Il

calcule numériquement $R_p = 0.841235640$ fm, avec une concordance de 99.95% avec CODATA 2019. Il généralise la formule

$R_{VED} = n\hbar/(Mc)$ pour toute masse confinée.

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The Proton

1. Introduction

- We continue from the deterministic 3S+T framework.
- We have defined the container (space-time) and the function f , ensuring causality and determinism.

- Quantum mechanics remains outside this analysis, since it cannot deterministically explain the properties of particles.

2. Particle with mass and intrinsic frequency

- Every particle with mass m has an associated frequency ν and wavelength λ :

$$E = mc^2 = h\nu \quad \Rightarrow \quad \nu = \frac{mc^2}{h}$$

- The associated Compton wavelength is:

$$\lambda_C = \frac{c}{\nu} = \frac{h}{mc}$$

- This wavelength is geometric and deterministic, linked to 3S+T space-time and the function f .

3. Geometric confinement axiom

- For a wave associated with a particle to be confined in a perimeter or enclosure, the space must contain an exact integer number of complete waves:

$$L = n\lambda_C, \quad n \in \mathbb{Z}^+$$

- If not satisfied, the enclosure will not be stable. Stability requires structural regularity along the temporal line.

4. Proton confinement

- The minimum stable enclosure of the proton must close the wave in the three spatial dimensions and time (X-T, Y-T, Z-T).

- Minimum number of waves for stability: $n_{\min} = 4$.
- This generates three internal structures that geometrically explain the "color charge".

5. Derivation of the proton's mass and radius

- Intrinsic Compton wavelength: $\lambda_p = \frac{h}{m_p c}$
- Minimum perimeter: $L_p = n_{\min} \cdot \lambda_p = 4 \cdot \lambda_p$
- Perimeter-radius relation for spherical confinement: $2\pi r_p = L_p$

$$r_p = \frac{L_p}{2\pi} = \frac{4\lambda_p}{2\pi} = \frac{2}{\pi} \cdot \lambda_p$$

Numerical calculation with CODATA 2022 values:

- $h = 6.62607015 \times 10^{-34} \text{ J}\cdot\text{s}$
- $m_p = 1.67262192369 \times 10^{-27} \text{ kg}$
- $c = 2.99792458 \times 10^8 \text{ m/s}$

$$\lambda_p = \frac{6.62607015 \times 10^{-34}}{1.67262192369 \times 10^{-27} \cdot 2.99792458 \times 10^8} \approx 1.321409 \times 10^{-15} \text{ m}$$

$$r_p = \frac{2}{\pi} \cdot 1.321409 \times 10^{-15} \approx 8.412 \times 10^{-16} \text{ m}$$

Comparison with experimental CODATA value:

- Proton charge radius CODATA:

$$8.414 \times 10^{-16} \text{ m } (\pm 0.019 \times 10^{-16})$$

- **Difference:** $0.002 \times 10^{-16} \text{ m}$ (**0.024% discrepancy**)

Equivalent alternative formulation:

$$r_p = n_{\min} \cdot \frac{\hbar}{m_p c} = 4 \cdot \frac{\hbar}{m_p c}$$

where $\hbar = h/(2\pi)$.

6. Generalization: Radius and mass associated with geometric confinement

- Every confined mass has a deterministic geometric radius:

$$R_{\text{VED}} = \frac{2}{\pi} \cdot \lambda_C \cdot n = n \cdot \frac{\hbar}{Mc}$$

- Where $\lambda_C = h/(Mc)$ and n = minimum number of waves for stability.
- Applicable to particles, macroscopic bodies, black holes, and the universe.

- R_{VED} should not be confused with observable radii of black holes; it is intrinsic to wave confinement.

7. Conclusion

1. Mass = confined wave in 3S+T.
2. Radius and mass associated with geometric confinement (R_{VED} , M_{VED}) are exact and deterministic.
3. The formula $R_{VED} = n \cdot \hbar / (Mc)$ will be a fundamental tool in later developments.
4. For the proton, with $n = 4$, we obtain $r_p \approx 8.412 \times 10^{-16} \text{ m}$, in excellent agreement with the experimental value.

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