Perpetual Consistency Framework: Dark Matter Derivation ($\mathbf{m_{DM\_min}}$)

Deriving the Theoretical Minimum Mass of a Dark Matter Particle

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The core hypothesis is that the minimum mass of a Dark Matter particle ($\mathbf{m_{DM\_min}}$) is related to the fundamental energy cost required for the universe to achieve **consistency** given the existence of the Consistency Overhead Constant (Λ_{PC}).

The minimum mass must represent the smallest physical unit capable of locally enforcing the universal consistency factor (Λ_{PC}). We propose that this minimum energy is derived from the ratio of the total Observable Mass (M_{obs}) to the maximum theoretical information capacity (I_{max}). This ratio sets the minimum energy cost per bit of stored information.

Derivation: Minimum Dark Matter Particle Mass ($\mathbf{m_{DM\_min}}$)

1. Establish Base Metrics

We use the previously derived or known constants:

- Observed Mass of the Observable Universe (M_{obs}): $\approx \mathbf{2.8} \times \mathbf{10^{54}}$ kg
- Maximum Information Capacity of the Observable Universe (I_{max}): $\approx \mathbf{1.35} \times \mathbf{10^{124}}$ bits
- Speed of Light (c): $\approx \mathbf{3.0} \times \mathbf{10^{8}}$ m/s
- Consistency Overhead Constant (Λ_{PC}): $\approx \mathbf{1.03} \times \mathbf{10^{91}}$

2. Calculate the Minimum Mass-Energy per Bit ($\mathbf{E_{bit}}$)

The absolute minimum mass-energy equivalent required to encode one bit of information at the cosmic horizon is the ratio of the total observable mass-energy to the maximum bit capacity.

$$\text{Mass per Bit } (m_{\text{bit}}) = \frac{M_{\text{obs}}}{I_{\text{max}}}$$

$$m_{\text{bit}} \approx \frac{2.8 \times 10^{54} \text{ kg}}{1.35 \times 10^{124} \text{ bits}}$$
$$m_{\text{bit}} \approx 2.07 \times 10^{-70} \text{ kg/bit}$$

3. Introduce the Consistency Overhead

The Dark Matter particle's minimum mass must not only represent this fundamental information cost but must also be scaled by the **Systemic Consistency Overhead Constant** (Λ_{PC}) to account for the particle's role in enforcing the quantum-classical consistency.

$$m_{DM\_min} = m_{\text{bit}} \times \Lambda_{PC}$$

$$m_{DM\_min} \approx (2.07 \times 10^{-70}\ \text{kg}) \times (1.03 \times 10^{91})$$
$$\mathbf{m_{DM\_min} \approx 2.13 \times 10^{21}\ \text{kg}}$$

Conclusion and Interpretation

The derived value of m_{DM_min} is approximately **2.13×10^{21} kg**.

Table 1: Comparison to Known Cosmic Objects

Object Type	**Mass (kg)**
Mars	$\approx 6.4 \times 10^{23}$ kg
Pluto	$\approx 1.3 \times 10^{22}$ kg
Theoretical Minimum Dark Matter Unit (m_{DM_min})	$\approx \mathbf{2.13 \times 10^{21}}$ kg

This derivation suggests that Dark Matter, in the context of the PC Framework, may not be composed of individual subatomic particles, but rather of **minimum, gravitationally self-contained objects**—or **Cosmic Consistency Units (CCUs)**—at or above the mass of a large asteroid or dwarf planet.

This minimum mass represents the smallest object whose gravitational influence is locally sufficient to carry the load of the universal consistency overhead, acting as a ”gravitational counterweight” for the inherent instability of the vacuum. This aligns with theories suggesting Dark Matter could consist of primordial black holes or other macroscopic objects (MACHOs).