Axiom I
Radiative Origin of Inertia

February 20, 2026

Axiom

Axiom I (Impedance-Induced Inertia).
Inertial mass is not a fundamental property of matter. It emerges from the interaction between localized energy configurations and the electromagnetic impedance of free space.

Let the impedance of free space be defined as

$$Z_0 = \sqrt{\frac{\mu_0}{\varepsilon_0}}. \tag{1}$$

For any localized field configuration $\mathcal{C}$ undergoing acceleration $\mathbf{a}$, the vacuum induces a reactive force proportional to Z_0:

$$\mathbf{F}_{\text{vac}} = -m_{\text{eff}}\mathbf{a}. \tag{2}$$

The effective inertial mass m_{eff} is defined as the energetic cost required to maintain localization against the impedance of free space:

$$m_{\text{eff}}c^2 = \int_{\mathcal{C}} Z_0 \, \mathcal{J}_{\text{conf}} \, dV, \tag{3}$$

where $\mathcal{J}_{\text{conf}}$ denotes the confined energy current density within the configuration.

Interpretation

Under this axiom, particles are stationary or quasi-stationary field configurations. Inertia is the macroscopic manifestation of vacuum reaction.

This statement is postulated without derivation.