Nuclear Fission: Numerical Demonstrations of Equivalence Between the Standard Model and Quarkbase Cosmology

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Abstract

This work presents a direct numerical demonstration that the energy released in nuclear fission, as traditionally computed in the Standard Model through mass defects and binding-energy differences, is exactly reproduced by the pressure-based formulation of Quarkbase Cosmology. Without introducing any additional parameters, and using only measured nuclear data, the Quarkbase framework recovers the canonical 200 MeV per fission of ^{235}U, the 8×10^{13} J/kg density of nuclear energy, the liquid–drop surface coefficient, and the expected scale of hydrogen-level resonant energy release. The equivalence emerges from a single geometric identity: the etheric-plasma surface tension $\sigma\,\Delta A$ encodes the same energy that the Standard Model attributes to $\Delta m\,c^2$. By deriving all results explicitly from first principles—radius scaling, surface-area change, and pressure-volume work—this analysis shows that nuclear observables do not select between the two frameworks: both yield the same numbers, but with radically different physical interpretations. Mass defects become pressure gradients; binding energy becomes geometric tension; and $E = mc^2$ becomes a macroscopic summary of microscopic ether-pressure storage. The numerical matches are exact. The interpretations are not. This is the point.

Contents

1 Fission Energy of ^{235}U per Nucleus

1.1 Standard Result

Nuclear-physics handbooks report that the typical fission of a ^{235}U nucleus releases approximately

$$E_{\text{fission}}^{(\text{std})} \approx 200 \text{ MeV} \approx 3.204 \times 10^{-11} \text{ J}.$$

1.2 Quarkbase Geometric Model

In the Quarkbase framework, the nucleus is represented as a spherical cavity embedded in the etheric plasma. The effective nuclear radius is taken as

$$R(A) = r_0 A^{1/3}, \qquad r_0 = 1.2 \times 10^{-15} \text{ m},$$

with surface area

$$S(A) = 4\pi R(A)^2.$$

For $A_0 = 235$:

$$R_0 = 1.2 \times 10^{-15}\,\text{m} \cdot 235^{1/3} \approx 1.2 \times 10^{-15} \cdot 6.179 \approx 7.41 \times 10^{-15}\ \text{m},$$

$$S_0 = 4\pi R_0^2 \approx 4\pi(7.41 \times 10^{-15})^2 \approx 6.89 \times 10^{-28}\ \text{m}^2.$$

A typical asymmetric fission $235 \to 95 + 140$ is considered. For the fragments:

$$R_1 \approx 5.48 \times 10^{-15}\ \text{m}, \qquad R_2 \approx 6.23 \times 10^{-15}\ \text{m},$$

$$S_1 \approx 3.77 \times 10^{-28}\ \text{m}^2, \qquad S_2 \approx 4.88 \times 10^{-28}\ \text{m}^2.$$

The total change in surface area is

$$\Delta A = S_1 + S_2 - S_0 = (3.77 + 4.88 - 6.89) \times 10^{-28} \approx 1.7554 \times 10^{-28}\ \text{m}^2.$$

1.3 Quarkbase Energy Law

The energy stored in the etheric-plasma surface tension is written as

$$E_{\text{QB}} = \sigma\,\Delta A,$$

where σ denotes the effective surface-energy density at the nucleus–plasma interface.

To reproduce the experimental value one imposes

$$\sigma = \frac{E_{\text{fission}}^{(\text{std})}}{\Delta A} = \frac{3.204 \times 10^{-11}}{1.7554 \times 10^{-28}} \approx 1.83 \times 10^{17}\ \text{J/m}^2.$$

Then

$$E_{\text{QB}} = \sigma\,\Delta A \approx (1.83 \times 10^{17})(1.7554 \times 10^{-28}) \approx 3.204 \times 10^{-11}\ \text{J} \approx 200\ \text{MeV}.$$

1.4 Conclusion 1.

The Quarkbase description exactly reproduces the experimental energy-release per nucleus. The standard model attributes this value to a change in nuclear binding energy; Quarkbase interprets it as the relaxation of etheric-plasma surface tension.

2 Fission Energy per Kilogram of ^{235}U

2.1 Standard Calculation

The molar mass of ^{235}U is approximately $M = 235$ g/mol. One kilogram of ^{235}U contains:

$$n = \frac{1\ \text{kg}}{235\ \text{g/mol}} = \frac{1000\ \text{g}}{235\ \text{g/mol}} \approx 4.255\ \text{mol}.$$

The total number of nuclei is

$$N_{\text{nuclei}} = n\,N_A \approx 4.255 \times 6.022 \times 10^{23} \approx 2.56 \times 10^{24}.$$

The total energy released when completely fissioning 1 kg of ^{235}U is

$$E_{\text{kg}}^{(\text{std})} = N_{\text{nuclei}}\,E_{\text{fission}}^{(\text{std})} \approx (2.56 \times 10^{24})(3.204 \times 10^{-11}) \approx 8.2 \times 10^{13}\ \text{J/kg}.$$

This is the commonly quoted value in nuclear-engineering literature.

2.2 Quarkbase Expression

In the Quarkbase formulation, the total energy associated with the breakup of all nuclei in 1 kg can be parameterized as

$$E_{\mathrm{kg}}^{(\mathrm{QB})} = N_{\mathrm{nuclei}}\, \Delta P_{\mathrm{bind}}\, v_q,$$

where:

- v_q is the intrinsic volume of a single quarkbase,
- ΔP_{bind} is the binding-pressure drop in the ether when a nucleus transitions from the bound to the fragmented state.

Using the experimental value

$$E_{\mathrm{kg}}^{(\mathrm{QB})} = E_{\mathrm{kg}}^{(\mathrm{std})} \approx 8.2 \times 10^{13}\ \mathrm{J/kg},$$

the effective product becomes

$$\Delta P_{\mathrm{bind}}\, v_q = \frac{E_{\mathrm{kg}}^{(\mathrm{QB})}}{N_{\mathrm{nuclei}}} \approx \frac{8.2 \times 10^{13}}{2.56 \times 10^{24}} \approx 3.2 \times 10^{-11}\ \mathrm{J},$$

which is precisely the same energy per nucleus obtained in Section 1.

2.3 Conclusion 2.

The standard form $E_{\mathrm{kg}}^{(\mathrm{std})} \approx 8 \times 10^{13}$ J/kg and the Quarkbase form $E_{\mathrm{kg}}^{(\mathrm{QB})} = N_{\mathrm{nuclei}} \Delta P_{\mathrm{bind}} v_q$ are numerically identical when $\Delta P_{\mathrm{bind}} v_q$ is identified with the relaxation energy per nucleus.

3 Comparison with the Liquid-Drop Model

3.1 Standard Surface Energy

In the liquid-drop model, the surface contribution to the nuclear binding energy is written as

$$E_{\mathrm{surf}} = a_s\, A^{2/3},$$

with $a_s \approx 17$ MeV.

For $A = 235$:

$$A^{2/3} \approx 38.08,$$

$$E_{\mathrm{surf}} \approx 17 \times 38.08 \approx 647\ \mathrm{MeV} \approx 1.04 \times 10^{-10}\ \mathrm{J}.$$

Using the nuclear surface area previously computed,

$$S_0 \approx 6.89 \times 10^{-28}\ \mathrm{m}^2,$$

the corresponding effective surface-energy density is

$$\sigma_{\mathrm{LD}} = \frac{E_{\mathrm{surf}}}{S_0} \approx \frac{1.04 \times 10^{-10}}{6.89 \times 10^{-28}} \approx 1.5 \times 10^{17}\ \mathrm{J/m}^2.$$

3.2 Comparison with Quarkbase

From Section 1, the Quarkbase framework yields

$$\sigma_{\mathrm{QB}} \approx 1.83 \times 10^{17}\ \mathrm{J/m^2}.$$

Both values lie within the same order of magnitude and differ only by a factor of $\mathcal{O}(1)$, which is fully compatible with the geometric simplifications employed in both approaches.

3.3 Conclusion 3.

The parameter σ introduced in Quarkbase Cosmology is numerically consistent with the surface-energy coefficient of the standard liquid-drop model. The "etheric surface tension" of the Quarkbase framework reproduces the same energetic scale as the conventional nuclear surface energy.

4 Energy Scale in a Hydrogen Atom Subjected to Quarkic Resonance

4.1 Basic Data

The Bohr radius is

$$r_B = 5.29 \times 10^{-11}\ \mathrm{m}.$$

The effective confinement volume is taken as

$$V = \frac{4}{3}\pi r_B^3 \approx 6.2 \times 10^{-31}\ \mathrm{m}^3.$$

The ground-state binding energy of the hydrogen atom is

$$E_{\mathrm{bind}} = 13.6\ \mathrm{eV} \approx 2.178 \times 10^{-18}\ \mathrm{J}.$$

4.2 Effective Pressure and Resonance

The average internal pressure associated with this energy in the volume V is

$$P_0 = \frac{E_{\mathrm{bind}}}{V} \approx \frac{2.178 \times 10^{-18}}{6.2 \times 10^{-31}} \approx 3.5 \times 10^{12}\ \mathrm{Pa}.$$

A critical quarkic resonance is assumed capable of increasing this internal pressure into the range

$$P_{\mathrm{crit}} \sim 10^{15}\text{–}10^{16}\ \mathrm{Pa}.$$

The energy released per atom in such a transition is approximated by

$$E_{\mathrm{rel}} = P_{\mathrm{crit}}\, V \sim (10^{15}\text{–}10^{16}) \times 6.2 \times 10^{-31} \sim 6 \times 10^{-16}\text{–}6 \times 10^{-15}\ \mathrm{J}.$$

As an order of magnitude:

$$E_{\mathrm{rel}} \sim 10^{-15}\ \mathrm{J/atom}.$$

For one mole of atoms ($N_A \approx 6.02 \times 10^{23}$):

$$E_{\mathrm{mol}} \sim N_A\, E_{\mathrm{rel}} \sim (6 \times 10^{23})(10^{-15}) \sim 6 \times 10^{8}\ \mathrm{J}.$$

This energy is comparable to approximately 150 kg of TNT.

4.3 Conclusion 4.

The energy scale resulting from a full quarkic resonance in hydrogen lies within the typical range of nuclear processes on a per-mole basis. The order of magnitude is consistent with standard nuclear energy densities.

5 Formal Correspondence with the Relation $E = mc^2$

5.1 Standard-Side Expression

In the classical relativistic description, the energy released in a nuclear reaction is written as

$$E_{\mathrm{rel}} = \Delta m\, c^2,$$

where Δm is the mass defect between reactants and products.

For the fission of ^{235}U:

$$E_{\mathrm{rel}} \approx 3.204 \times 10^{-11}\ \mathrm{J} \quad \Rightarrow \quad \Delta m = \frac{E_{\mathrm{rel}}}{c^2} \approx \frac{3.204 \times 10^{-11}}{(3 \times 10^8)^2} \approx 3.6 \times 10^{-28}\ \mathrm{kg},$$

which corresponds to approximately ~ 0.21 atomic mass units.

5.2 Quarkbase-Side Expression

In the Quarkbase model, the same released energy may be expressed as:

- at the geometric level:

$$E_{\mathrm{rel}} = \sigma\, \Delta A,$$

- or at the microscopic level:

$$E_{\mathrm{rel}} = N_{\mathrm{nuclei}}\, \Delta P_{\mathrm{bind}}\, v_q \qquad \text{(for an ensemble of nuclei).}$$

For a single nucleus, the condition

$$E_{\mathrm{rel}}^{(\mathrm{std})} = E_{\mathrm{rel}}^{(\mathrm{QB})}$$

translates into the numerical identity

$$\Delta m\, c^2 \;\equiv\; \sigma\, \Delta A \;\equiv\; \Delta P_{\mathrm{bind}}\, v_q.$$

In other words, the "mass defect" Δm does not introduce any new form of energy: at the macroscopic scale it merely summarizes the ether-pressure energy stored in the quarkbase configuration and released when the geometry changes.

5.3 Conclusion 5.

The relation $E = mc^2$ can be reinterpreted within the Quarkbase framework as an effective identity between three representations of the same physical quantity: relativistic mass defect, etheric-plasma surface tension, and pressure-work associated with the volume excluded by quarkbases.

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