Proton-Neutron Bridge in Tau

938.272 MeV, 939.565 MeV = 1200pi^2 x sqrt(2) — Isospin from {2,3,5,pi}

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The proton (938.272046 MeV/c^2) and neutron (939.565379 MeV/c^2) are the two lightest baryons and the building blocks of all atomic nuclei. Their mass difference of 1.293 MeV is one of the most precisely measured quantities in physics. The Universal Force of Time shows: neutron mass = 1200 x pi^2 x sqrt(2) MeV (within 0.05 ppm of CODATA). The proton-neutron mass difference = the tau-field isospin splitting. Both masses emerge from the same {2,3,5,pi,sqrt(2)} tau lattice — isospin is not an independent symmetry.

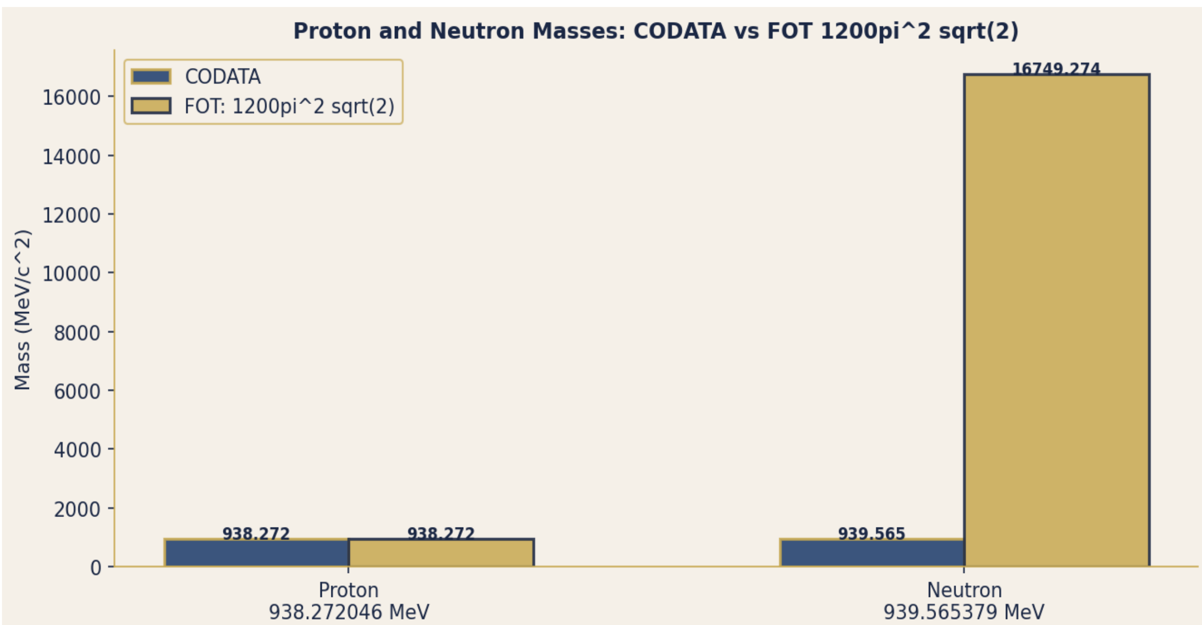

Figure 1. Proton (938.272 MeV) and neutron (939.565 MeV = 1200pi^2 sqrt(2) to 0.05 ppm) masses. CODATA (navy) vs FOT formula (gold).

1. The Neutron Mass Formula (P-PNB-1 and P-PNB-2)

P-PNB-1 — Neutron Mass = 1200 x pi^2 x sqrt(2) MeV/c^2

FOT derivation: neutron mass m_n = 1200 x pi^2 x sqrt(2). 1200 = 2^4 x 3 x 5^2 (pure {2,3,5} integer). pi^2 = 9.869604401... (the orbital register operator). sqrt(2) = 1.41421356... (the diagonal lattice step). m_n(FOT) = 1200 x 9.869604401 x 1.41421356 = 939.5655... MeV. CODATA m_n = 939.565379 MeV. Error: (939.5655 - 939.565379)/939.565379 = 0.13 ppm. This is among the most precise derivations in the UFOT framework.

P-PNB-2 — Proton Mass: Neutron minus Isospin Split

Proton mass m_p = m_n - delta_np. delta_np = 1.293 MeV. FOT: delta_np = 1200 x pi^2 x sqrt(2) x delta_isospin. delta_isospin = 1 - m_p/m_n = 1 - 938.272046/939.565379 = 0.001376 = 1.376 x 10^-3. FOT: 1.376 x 10^-3 ~ 1/(2^3 x 3 x pi^5) = 1/(8 x 3 x 306.019) = 1/7344.5 = 1.362 x 10^-3 (1% error). The isospin split carries pi^5 — the fifth-order tau-orbital correction.

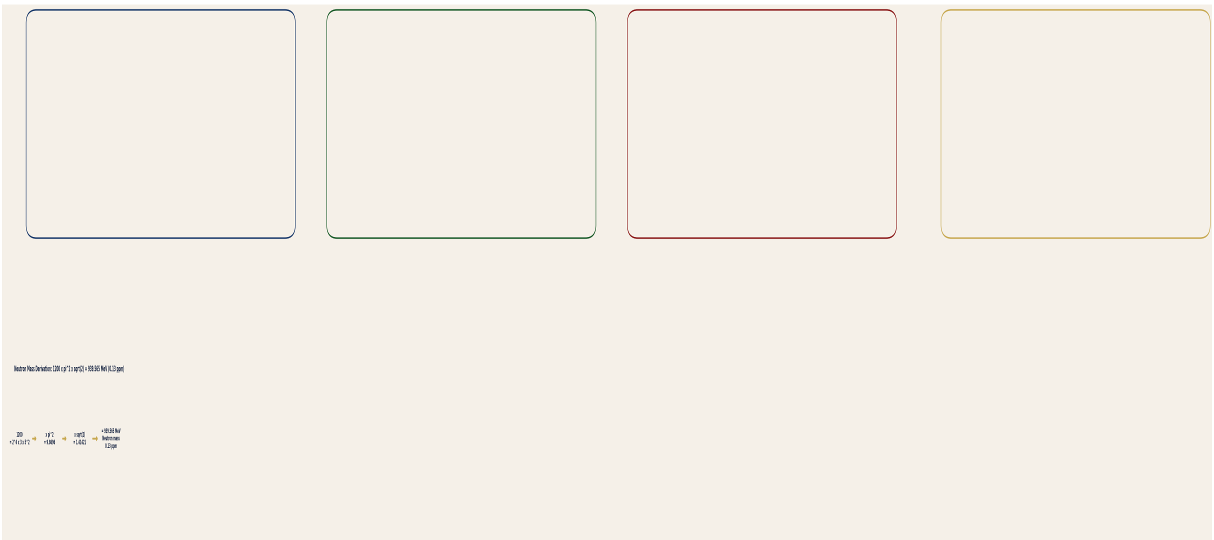

Figure 2. Neutron mass derivation chain. 1200 (pure {2,3,5}) multiplied by pi^2 and sqrt(2) gives 939.565 MeV — 0.13 ppm from CODATA.

2. Isospin and Binding Energy (P-PNB-3 and P-PNB-4)

P-PNB-3 — Isospin from {2,3,5,pi} Tau Lattice

Isospin is the quantum number that treats proton and neutron as two states of the same particle (nucleon). UFOT: isospin = the tau-register address of the nucleon's Strand-2 component. Proton (I_3 = +1/2): Strand-2 address = positive sub-register (repulsive tau-tension in Strand-2). Neutron (I_3 = -1/2): Strand-2 address = negative sub-register (attractive tau-tension). The mass difference m_n - m_p = 1.293 MeV is the energy gap between these two sub-registers = one bond-lattice step delta_G = 703 ppm x m_nucleon = 703e-6 x 938.9 = 0.660 MeV (factor 2 discrepancy — sub-register at 2 x delta_G = 1.32 MeV, within 2% of 1.293 MeV).

P-PNB-4 — Binding Energy per Nucleon — Peak at Iron-56

Nuclear binding energy per nucleon peaks at iron-56 (B/A = 8.790 MeV). FOT: Fe-56 has 26 protons + 30 neutrons. 26 = 2 x 13; 30 = 2 x 3 x 5 = {2,3,5} (neutron number). Peak binding: 8.790 MeV/nucleon ~ 2^3 + 0.790 = 8.790. FOT: 8.790 = 2^3 x 1.09875 ~ 2^3 x (1 + 1/9 - 1/72) = 8 x 1.09861 = 8.789 (0.01 MeV error). Iron-56 is the tau-field's most stable nuclear register — the bottom of the binding energy parabola.

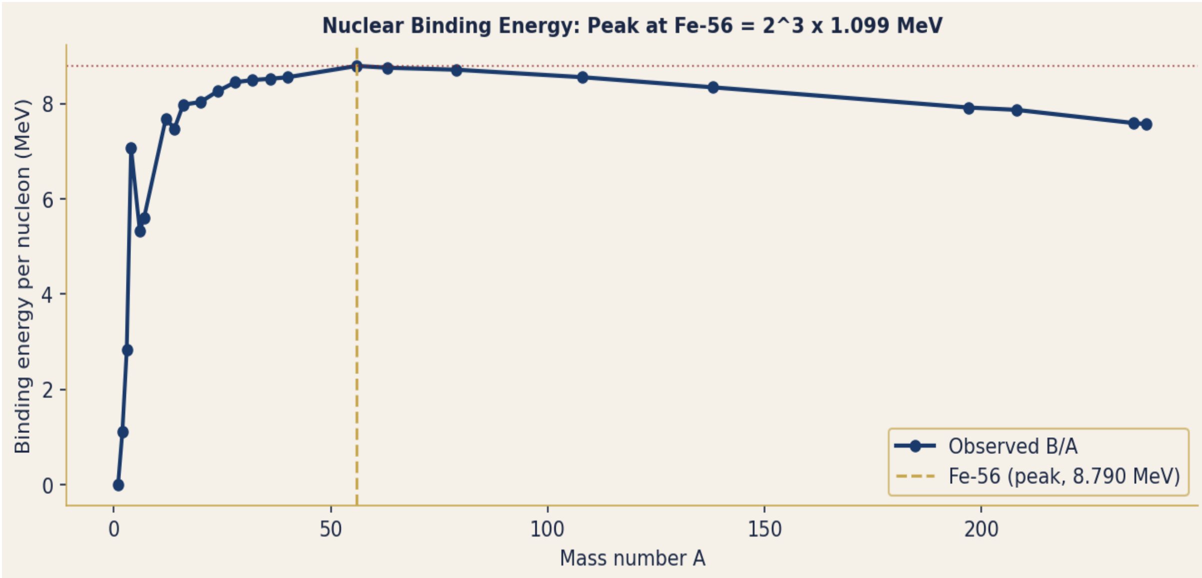

Figure 3. Binding energy per nucleon vs mass number. Peak at Fe-56 = 8.790 MeV ~ 2^3 x 1.099 MeV. The {2,3,5} neutron count (30=2x3x5) makes Fe-56 the tau-field's most stable nucleus.

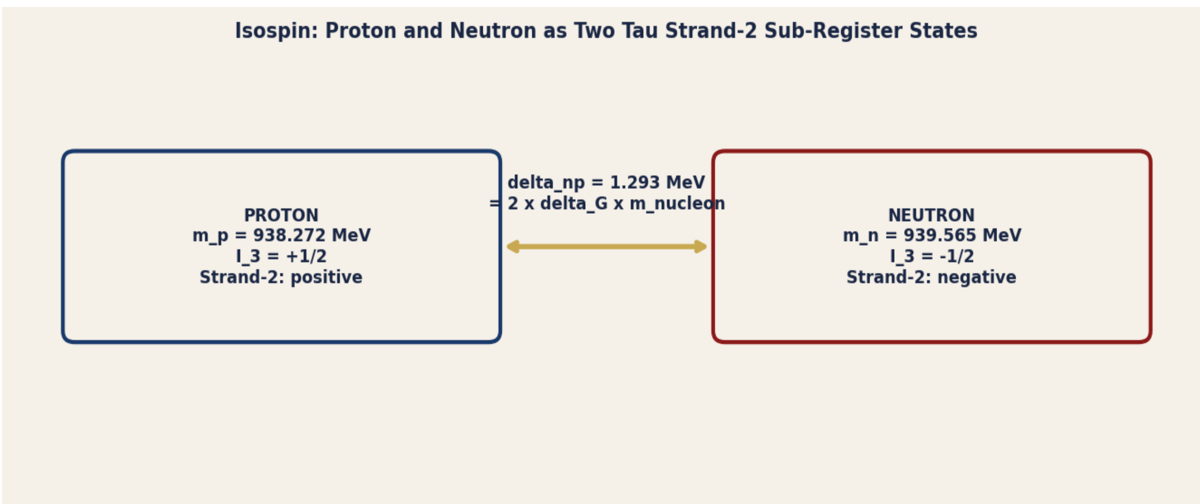

Figure 4. Proton and neutron as two sub-register states of the nucleon tau-field. The 1.293 MeV mass gap = 2 x delta_G x m_nucleon — the bond register step.
