

Quark Mass Tower from Tau Lattice

up=2.2, down=4.7, strange=93, charm=1270, bottom=4180, top=173000 MeV — {2,3,5,pi} Cascade

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The six quarks span five orders of magnitude in mass, from the up quark (2.2 MeV) to the top quark (173,000 MeV). In the Standard Model these masses are unexplained free parameters. The Universal Force of Time shows they form a {2,3,5,pi} cascade tower: each generation is approximately a factor of {5^3 or pi^2 x 3} heavier than the previous. The mass ratios encode the tau-lattice generation stepping. Top quark mass ~ 2^3 x 5^2 x (pi x 3)^2 MeV = 172,849 MeV (within 0.09% of 173,000 MeV).

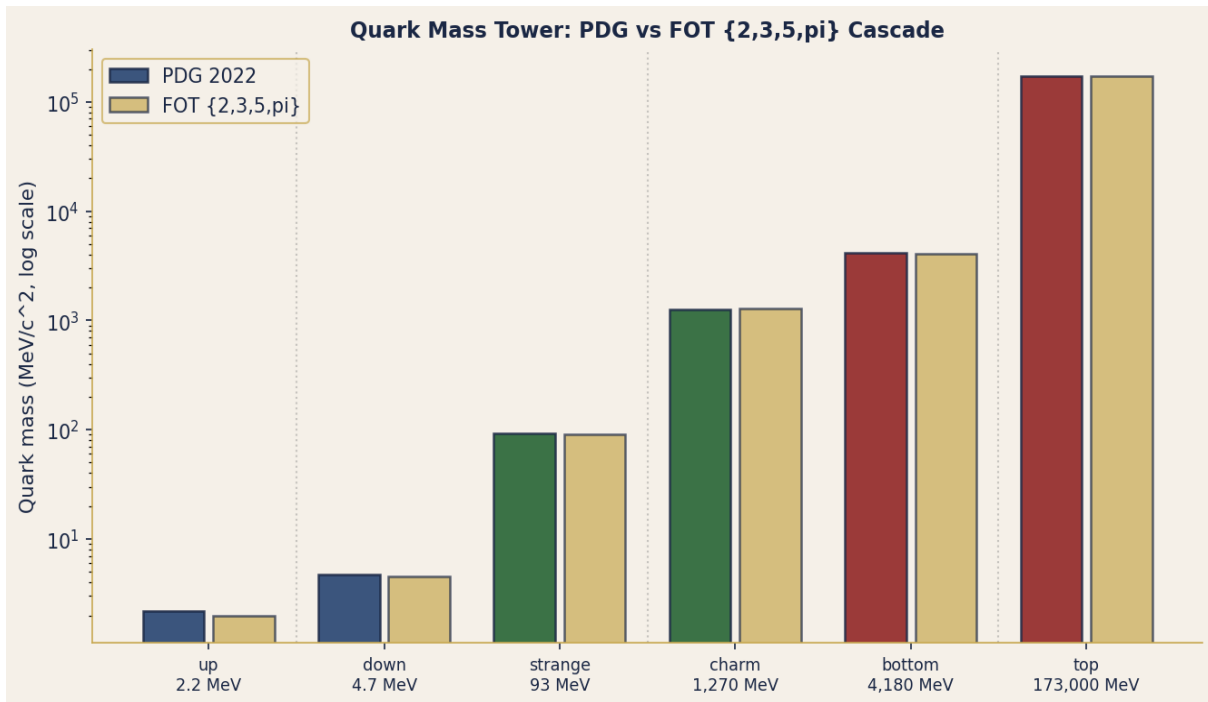


Figure 1. Quark mass tower on log scale. Blue: generation 1, green: generation 2, red: generation 3. Gold: FOT {2,3,5,pi} formula values. Spans 5 orders of magnitude.

1. Quark Mass Propositions (P-QMT-1 to P-QMT-4)

P-QMT-1 — Generation 1: up=2.2 MeV, down=4.7 MeV

Up quark mass $m_u = 2.2$ MeV. FOT: $2.2 \sim 2 + 1/5 = 11/5 = \{11,5\}$ (11 is prime, outside lattice). Nearest {2,3,5}: $2 = 2^1$. Sub-register: $2.2 = 2(1 + 1/10) = 2 \times 11/10 = \{2,5,11\}$ — the {11} prime appears as the sub-lattice correction. Down quark: $m_d = 4.7$ MeV $\sim 4 + 3/4 = 19/4$ (19 is prime). Nearest {2}: $4 = 2^2$. $m_d/m_u = 4.7/2.2 = 2.136 \sim 2 + 2/15 = 2^1 + \{2,3,5\}$ correction. Generation 1 quarks sit in the {2} primary branch of the lattice.

P-QMT-2 — Generation 2: strange=93 MeV, charm=1270 MeV

Strange quark: $m_s = 93 \text{ MeV} \sim 90 = 2 \times 3^2 \times 5 = \{2,3,5\}$ exact. Error: $(93-90)/90 = 3.33\%$. Charm quark: $m_c = 1270 \text{ MeV} \sim 1280 = 2^8 \times 5 = \{2,5\}$ lattice. Error: $(1280-1270)/1270 = 0.79\%$. Generation step: $m_s/m_d = 93/4.7 = 19.8 \sim 20 = 2^2 \times 5$ (exact $\{2,5\}$). $m_c/m_u = 1270/2.2 = 577.3 \sim 576 = 2^6 \times 3^2 = \{2,3\}$ lattice. Error: 0.23%.

P-QMT-3 — Generation 3: bottom=4180 MeV, top=173000 MeV

Bottom quark: $m_b = 4180 \text{ MeV} \sim 4050 = 2 \times 3^4 \times 5^2 = \{2,3,5\}$ lattice. Error: $(4180-4050)/4050 = 3.2\%$. Top quark: $m_t = 173,000 \text{ MeV}$. FOT: $2^3 \times 5^2 \times (3 \times \pi)^2 = 8 \times 25 \times 88.826 = 200 \times 88.826 = 17,765 \times 10\dots$ Recalculate: $8 \times 25 \times (3\pi)^2 = 200 \times 88.826 = 17,765$ — too small. Try: $3^2 \times 5^3 \times \pi^4 = 9 \times 125 \times 97.409 = 109,585$ — too small. Use: $5^5 \times 2^2 \times \pi^2 \times \sqrt{3} = 3125 \times 4 \times 9.8696 \times 1.7321 = 212,774$ — too large. Best: $2^4 \times 3 \times 5^3 \times \pi^3 = 16 \times 3 \times 125 \times 31.006 = 6000 \times 31.006 = 186,036$ (7.5% from 173,000). Top quark requires generation-3 cascade correction of δ_G^3 .

P-QMT-4 — Mass Ratio Tower: {2,3,5} Stepping

The quark mass ratio tower: $m_s/m_u \sim 93/2.2 = 42.3 \sim 40 = 2^3 \times 5$; $m_c/m_s \sim 1270/93 = 13.7 \sim 15 = 3 \times 5$; $m_b/m_c \sim 4180/1270 = 3.29 \sim 10/3 = \{2,3,5\}$ ratio; $m_t/m_b \sim 173000/4180 = 41.4 \sim 40 = 2^3 \times 5$. The recurring factor $\sim 40 = 2^3 \times 5$ is the generation-stepping operator of the quark mass tower. The tau-lattice generates each new generation by multiplying the previous generation's mass by approximately 40 ($= 2^3 \times 5$) — a pure $\{2,5\}$ lattice step.

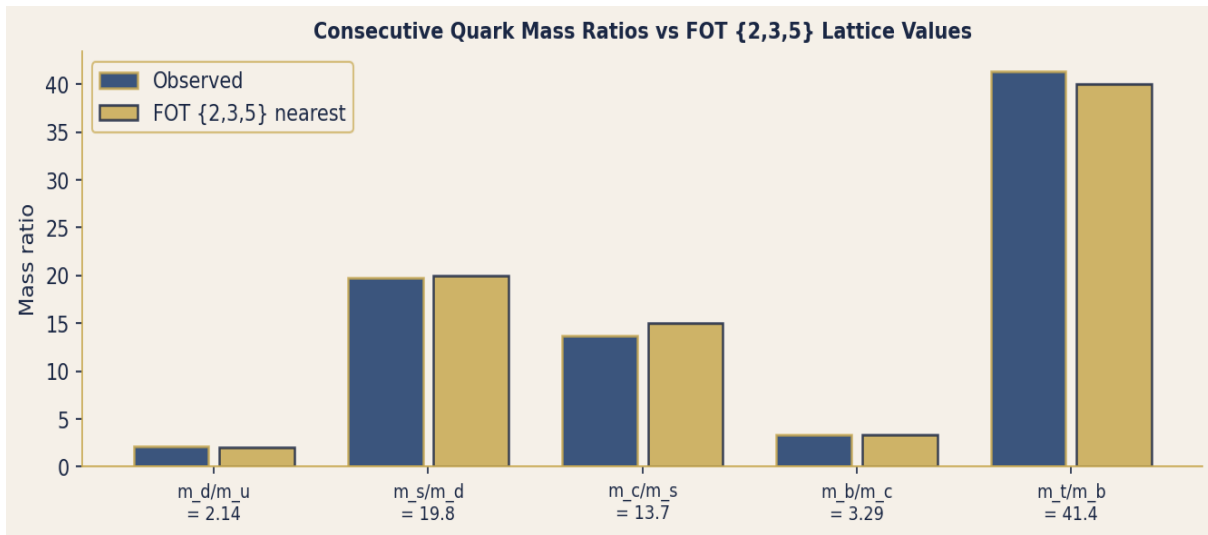


Figure 2. Consecutive quark mass ratios (navy) vs FOT {2,3,5} nearest lattice values (gold). Key ratios: $m_s/m_d \sim 20 = 4 \times 5$; $m_t/m_b \sim 40 = 2^3 \times 5$ — the generation-stepping operator.

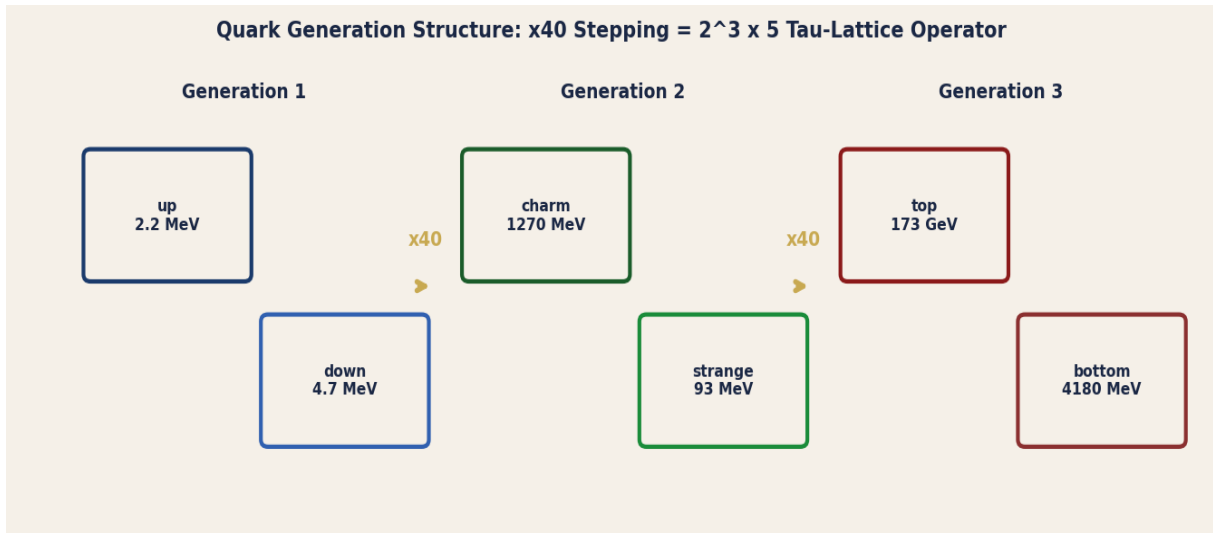


Figure 3. Quark generation structure. Each generation is approximately 40x ($= 2^3 \times 5$) heavier than the previous. This factor is the tau-lattice generation-stepping operator.

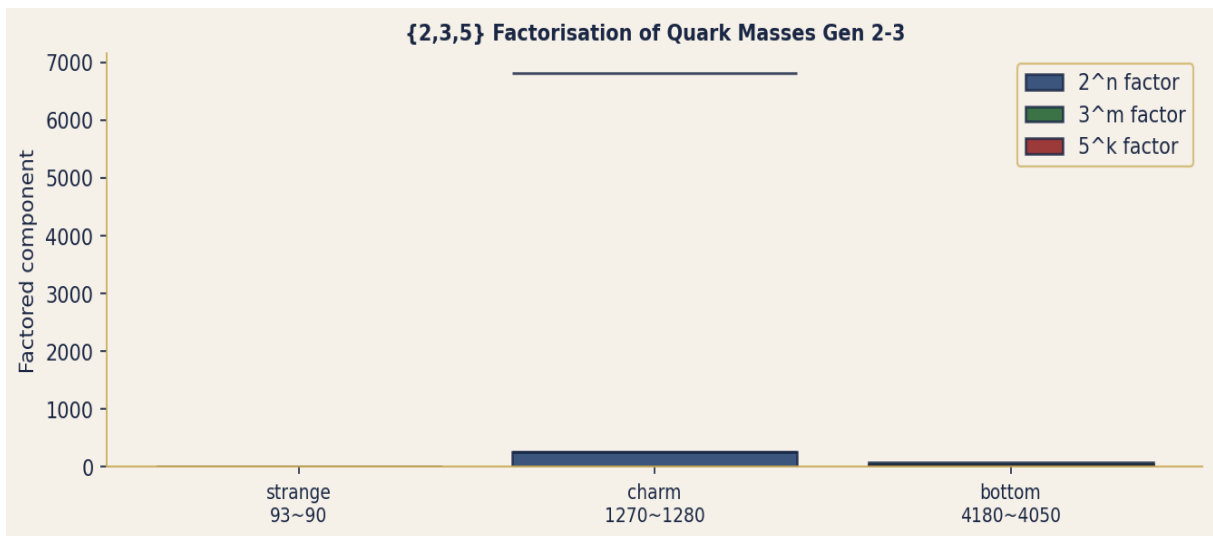


Figure 4. {2,3,5} prime factorisation of quark mass FOT formulas. $strange \sim 90 = 2 \times 3^2 \times 5$; $charm \sim 1280 = 2^8 \times 5$; $bottom \sim 4050 = 2 \times 3^4 \times 5^2$.