Title: Approximations

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Abstract: The set of generating values, $\{(4\pi), (4\pi - 1/\pi), (4\pi - 2/\pi), (4\pi - 3/\pi), (4\pi - 4/\pi), (\ln(4\pi))\}$, whose products can be used to approximate the mass ratios of the proton to the electron, the neutron to the electron, and the Higgs boson to the electron. For the proton-electron mass ratio there are several tri-axial ellipsoids whose volumes are numerically close to that ratio.
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Numerology: A great mathematician, Leopold Kronecker, once said that God gave us the natural numbers and everything else was man's creation.[1] He said:"Die ganzen Zahlen hat der liebe Gatt gemacht, alles andere ist Menschenwerk." (The dear God has made the whole numbers, all the rest is man's work.) The whole numbers are the "counting numbers." $(1, 2, 3, \ldots)$

Another great mathematician, Leonard Euler, once said that God lurks in the identity

$$e^{i\cdot\pi} + 1 = 0 \tag{1}$$

Where each of the eight symbols appears exactly one time.[2] The symbols include five numbers, two operations, and one equivalence relation. Each type of number is present. Exponentiation $(\wedge)$ is understood as a superscript.

$$a^b \text{ is } a \wedge b$$

Dimensionless Constants: Dimensionless constants appear in all branches of science as well as in mathematics. Every college freshman knows that π is a transcendental, irrational number, even if they do not know what "transcendental" means. Most, but not all, of the dimensionless constants come from physics and chemistry. The following number is an approximation to a dimensionless physics constant:

$$\frac{m_p}{m_e} \approx (4\pi)\left(4\pi - \frac{1}{\pi}\right)\left(4\pi - \frac{2}{\pi}\right) = 1836.15\ldots \tag{2}$$

[1] https://en.wikipedia.org/wiki/Leopold_ Kronecker
[2] https://www.mathsisfun.com/algebra/eulers-formula.html

Where m_e is the rest mass of the electron and m_p is the rest mass of the proton. If m_n is the rest mass of the neutron, we have

$$\frac{m_n}{m_e} \approx \ln(4\pi) + (4\pi)\left(4\pi - \frac{1}{\pi}\right)\left(4\pi - \frac{2}{\pi}\right) = 1838.68\ldots \quad (3)$$

Finally, if H^0 is the Higgs boson, then

$$\frac{m_{H^0}}{m_e} \approx \prod_{m=0}^{4}\left(4\pi - \frac{m}{\pi}\right) = 240773.71 \quad (4)$$

Where m_{H^0} is the mass of the Higgs boson.

Higgs Boson: The mass ratio of the Higgs boson to the mass of the electron is inconvenient. A better mass ratio is that of the mass of the Higgs boson to the mass of the proton.

$$\frac{m_{H^0}}{m_p} \approx \prod_{m=3}^{4}\left(4\pi - \frac{m}{\pi}\right) = 131.13\ldots \quad (5)$$

Area: Consider the area of a planar ellipse in 2D, with semi-axes as below

$$4\pi\left(4\pi - \frac{1}{\pi}\right) = (4\pi - 2)(4\pi + 2) = 153.9136704 \quad (6)$$

There is no stable particle with this rest mass, however. The factorization is not at all obvious. This gives another model for the proton.

Electron: The electron is generally considered to be a perfect solid sphere (ball) in classical geometry.[3] For convenience, we set the radius of the electron (r_e) equal to one. The electron mass has been measured to high precision.

Proton Models: The proton, unlike the electron, does not appear to be a solid sphere with uniform density. Two possible models for the proton mass are the triaxial ellipsoid (scalene ellipsoid)' and as an ellipsoid with an interior ellipsoid removed. More precisely, the proton mass model may be modeled as a solid triaxial ellipsoid with semi-axes $\{4\pi,\ 4\pi-\pi^{-1},\ 4\pi-2\pi^{-1}\}$. This ellipsoid has semi-axies arising from the *Inversion of the Spheres*.

[3]https://www.sciencedaily.com/releases/2011/05/110525131707.htm

Consider the solid sphere with radius $r = 4\pi - \pi^{-1}$. An ellipsoid interior to the sphere with semi-axes $\{4\pi - \pi^{-1},\ \pi^{-1},\ \pi^{-1}\}$ is removed. The different factorizations are given below:

$$(4\pi)\left(4\pi - \frac{1}{\pi}\right)\left(4\pi - \frac{2}{\pi}\right) = \left(4\pi - \frac{1}{\pi}\right)^3 - \left(4\pi - \frac{1}{\pi}\right)\frac{1}{\pi^2} = 1836.15\ldots$$

Compare with the product formula from $m = 0$ to $m = 4$ for an approximation to the Higgs boson. There is a *Generating Function.*

$$(4\pi)\left(4\pi - \frac{1}{\pi}\right)\left(4\pi - \frac{2}{\pi}\right) = \prod_{m=0}^{2}\left(4\pi - \frac{m}{\pi}\right)$$

A simple arithmetic expression is:

$$64\pi^3 - 48\pi + \frac{8}{\pi} = 1836.15\ldots$$

This can be used as the deletion of a sector or wedge from the ball with radius $r = (4\pi - 1/\pi)$. Yet another factorization is possible:

$$= (4\pi + 2)(4\pi - 2)\left(4\pi - \frac{2}{\pi}\right) = 1836.15\ldots \qquad (7)$$

This gives rise to another possible tri-axial ellipsoid, whose semi-axes are the same as those in the above equation. $\{4\pi + 2,\ 4\pi - 2,\ 4\pi - 2/\pi\}$

Inversion: In geometry, inversion in a sphere is a transformation of Euclidean space that fixes the points of a sphere while sending the points inside of the sphere to the outside of the sphere, and vice versa. Intuitively, it "swaps the inside and outside" of the sphere while leaving the points on the sphere unchanged.[4]

[4] https://en.wikipedia.org/wiki/Inversion_in_a_sphere