On the possible mathematical connections between Ramanujan formulas, equations concerning Primordial Black Holes and Inflation, Quantum Theory of Fields and some sectors of Number Theory.

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Abstract

In this research thesis, we describe and analyze the possible mathematical connections between Ramanujan formulas, equations concerning Primordial Black Holes and Inflation, Quantum Theory of Fields and some sectors of Number Theory.

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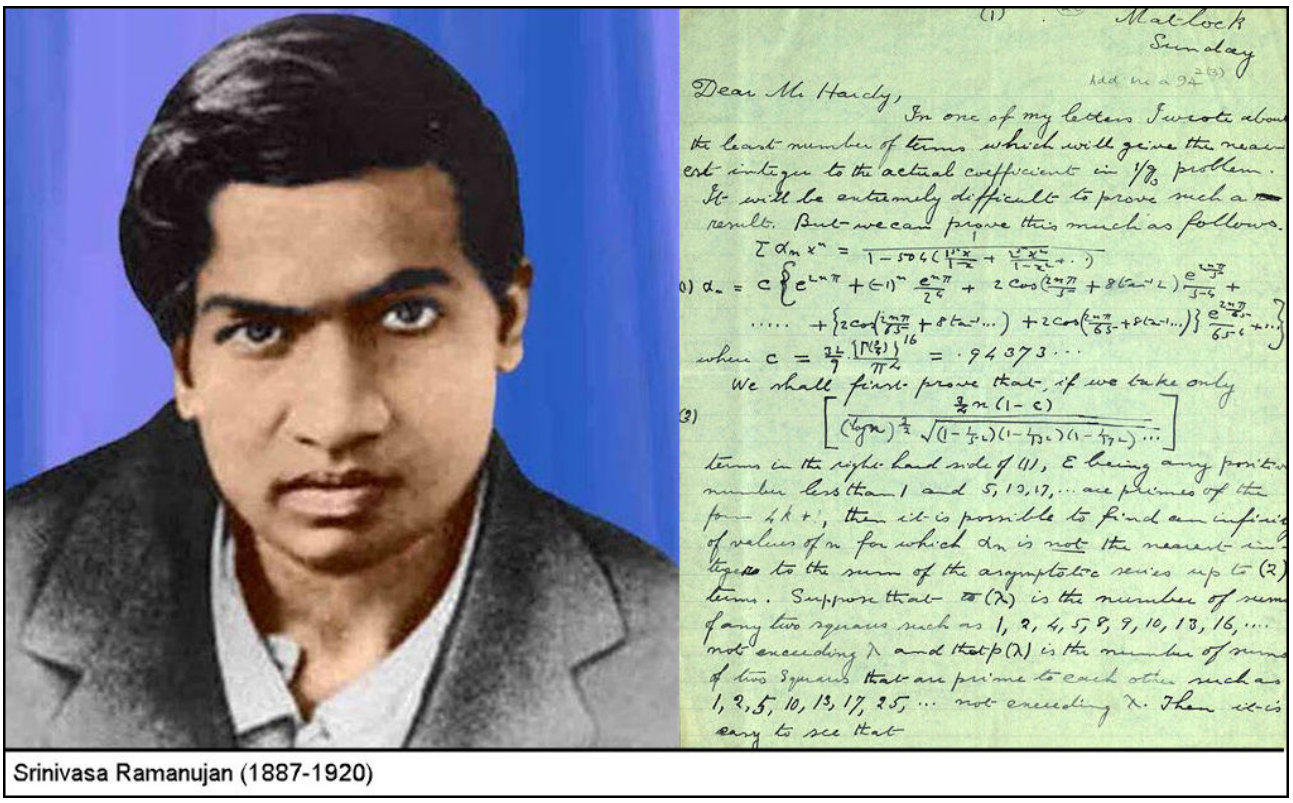


Srinivasa Ramanujan (1887-1920)

https://the-1000-year-view.com/2020/04/25/ramanujan-and-me/

We want to highlight that the development of the various equations was carried out according an our possible logical and original interpretation

From:

MODULAR EQUATIONS IN THE SPIRIT OF RAMANUJAN – *M. S. Mahadeva Naika* - Department of Mathematics, Central College Campus, Bangalore University, Bengaluru-560 001, INDIA "IIIT - BANGALORE" - June 25, 2012

Now, we have that:

$$\text{If } P := \frac{\varphi(q)}{\varphi(q^5)} \text{ and } Q := \frac{\varphi(-q^4)}{\varphi(-q^{20})}, \text{ then}$$

$$\frac{P^4}{Q^4} + \frac{Q^4}{P^4} + 24\left(\frac{P^2}{Q^2} + \frac{Q^2}{P^2}\right) + 8\left(P^2Q^2 + \frac{5^2}{P^2Q^2}\right) + 3\left(Q^4 + \frac{5^2}{Q^4}\right) + 120$$
$$= 20\left(P^2 + \frac{5}{P^2}\right) + 32\left(Q^2 + \frac{5}{Q^2}\right) + \left(P^2Q^4 + \frac{125}{P^2Q^4}\right) + 3\left(\frac{5P^2}{Q^4} + \frac{Q^4}{P^2}\right). \quad (72)$$

1+1+24(1+1)+8(1+5)+3(1+5)+120 = 20(1+5)+32(1+5)+(1+125)+3(5+1)

(((1+1+24(1+1)+8(1+5)+3(1+5)+120)))1.9322

Input interpretation:

$(1 + 1 + 24\,(1 + 1) + 8\,(1 + 5) + 3\,(1 + 5) + 120) \times 1.9322$

Result:

455.9992

455.9992

20(1+5)+32(1+5)+(1+125)+3(5+1)

Input:

$20\,(1 + 5) + 32\,(1 + 5) + (1 + 125) + 3\,(5 + 1)$

Result:

456

456

(((20(1+5)+32(1+5)+(1+x+4)+3(5+1)))) = 456

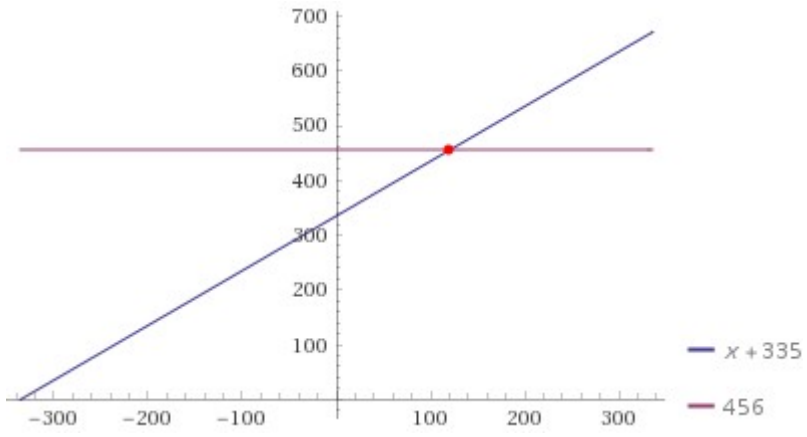
Input:

$20\,(1+5)+32\,(1+5)+(1+x+4)+3\,(5+1)=456$

Result:

$x+335=456$

Plot:



Alternate form:

$x-121=0$

Solution:

$x=121$

121

Or:

(((1+1+24(1+1)+8(1+5)+3(1+5)+x-1)))1.9322 = 455.9992

Input interpretation:

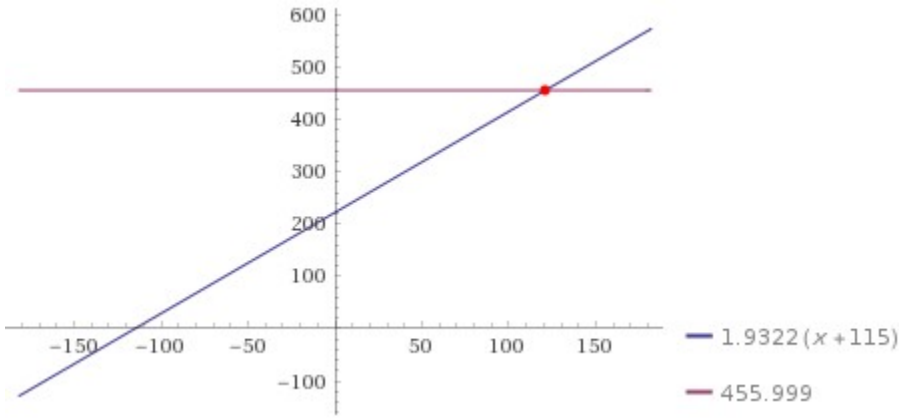
$(1+1+24\,(1+1)+8\,(1+5)+3\,(1+5)+x-1)\times 1.9322=455.9992$

Result:

$1.9322\,(x + 115) = 455.999$

$455.999 \approx 456$

Plot:



Alternate forms:

$1.9322\,(x + 115) = 455.999$

$1.9322\,x - 233.796 = 0$

$1.9322\,x + 222.203 = 455.999$

Solution:

$x \approx 121.$

121

That is also:

((-1 - 4 π + π^2 + π log(6)))*(1((+1+24(1+1)+8(1+5)+3(1+5)+x-1))) = 456

Input:

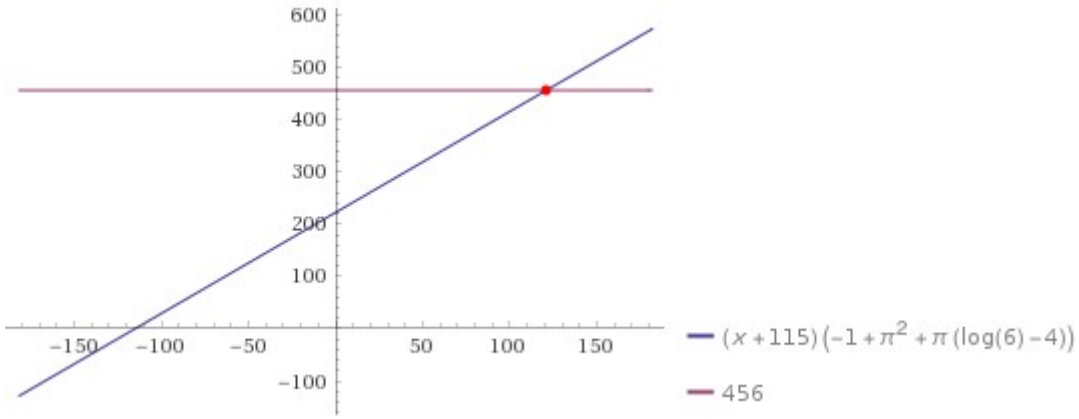
$(-1 - 4\,\pi + \pi^2 + \pi \log(6))\,(1 + 1 + 24\,(1 + 1) + 8\,(1 + 5) + 3\,(1 + 5) + x - 1) = 456$

$\log(x)$ is the natural logarithm

Exact result:

$$(x+115)\left(-1-4\pi+\pi^2+\pi\log(6)\right)=456$$

Plot:



Alternate forms:

$$(x+115)\left(\pi\left(-4+\pi+\log(6)\right)-1\right)=456$$

$$(x+115)\left(-1+\pi^2+\pi\left(\log(6)-4\right)\right)=456$$

$$\left(-1-4\pi+\pi^2\right)(x+115)+\pi(x+115)\log(6)=456$$

Alternate form assuming x>0:

$$\pi^2 x-4\pi x-x+\pi x(\log(2)+\log(3))+ 115\pi^2-460\pi-115+115\pi(\log(2)+\log(3))=456$$

Solution:

$$x=\frac{571-115\pi^2-115\pi(\log(6)-4)}{-1+\pi^2+\pi(\log(6)-4)}$$

Solution:

$x \approx 121.00$

121

From:

Primordial Black Holes- Perspectives in Gravitational Wave Astronomy -
Misao Sasaki, Teruaki Suyama, Takahiro Tanaka and Shuichiro Yokoyama
arXiv:1801.05235v1 [astro-ph.CO] 16 Jan 2018

4.4.6 Eccentricity

Eccentricity of the binary orbit has also a potential to discriminate the PBH scenario from the astrophysical scenarios.

First of all, circular binary and eccentric binary emit GWs whose waveforms look differently. Fig. 23 shows two GW waveforms from BH binaries consisting of the equal mass ($m_{\rm BH} = 30\,M_\odot$) with different eccentricities ($e = 0$ and $e = 0.5$) [284]. Amplitude of the waveforms are normalized. We find that the waveform for the eccentric orbit is modulated and show two phases, gentle hill and tall spike. The spike originates at the periastron where the acceleration of BHs as well as velocities are higher. This figure demonstrates that it is in principle possible to know the eccentricity of the binary from measurement of the time dependence of the waveform.

From

$$a = \frac{1}{1+z_{\rm eq}} \frac{\rho_{c,0}\Omega_m}{m_t} x^4,$$

a = ((1/(1+5)*1/(2*(30*1.9884e+30))))

mt = m1 + m2 = 2m

we have the following equation.

$$t = \frac{15}{304} \frac{a^4}{G^3 m_1 m_2 (m_1+m_2)} \left[\frac{(1-e^2)}{e^{\frac{12}{19}}} \left(1 + \frac{121}{304} e^2\right)^{\frac{870}{2299}} \right]^4 \int_0^e de' \, \frac{e'^{\frac{29}{19}}}{(1-e'^2)^{-\frac{3}{2}}} \left(1 + \frac{121}{304} e'^2\right)^{\frac{870}{2299}}.$$

From the last term

$$\int_0^e de' \, \frac{e'^{\frac{29}{19}}}{(1-e'^2)^{-\frac{3}{2}}} \left(1 + \frac{121}{304} e'^2\right)^{\frac{870}{2299}}.$$

we obtain:

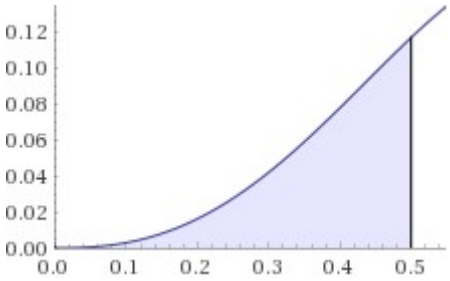
integrate(x^(29/19)/(1- x^2)^-1.5*(1+121x^2/304)^(870/2299))x, x = 0..0.5

Definite integral:

$$\int_0^{0.5} \frac{\left(x^{29/19}\left(1+\frac{121\,x^2}{304}\right)^{870/2299}\right)x}{\frac{1}{(1-x^2)^{1.5}}}\,dx = 0.0194305$$

0.0194305

Visual representation of the integral:



Thence:

$$t = \frac{15}{304}\frac{a^4}{G^3 m_1 m_2 (m_1+m_2)}\left[\frac{(1-e^2)}{e^{\frac{12}{19}}}\left(1+\frac{121}{304}e^2\right)^{\frac{870}{2299}}\right]^4 \int_0^e de' \frac{e'^{\frac{29}{19}}}{(1-e'^2)^{-\frac{3}{2}}}\left(1+\frac{121}{304}e'^2\right)^{\frac{870}{2299}}.$$

15/304 * (a^4)/(((6.6743e-11)^3*(30*1.9884e+30)^2*2*(30*1.9884e+30)))*[(1-0.5^2)/(0.5)^(12/19)*(1+121*0.5^2/304)^(870/2299)]^4 (0.0194305)

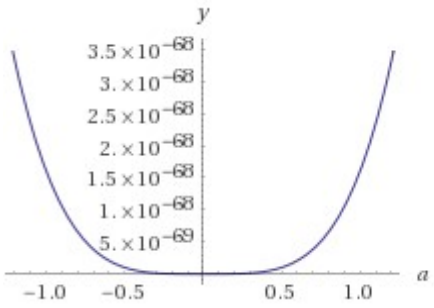
Input interpretation:

$$\frac{15}{304}\times\frac{a^4}{(6.6743\times10^{-11})^3\,(30\times1.9884\times10^{30})^2\times2\,(30\times1.9884\times10^{30})}\left(\frac{1-0.5^2}{0.5^{12/19}}\left(1+121\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305$$

Result:

$1.59839\times10^{-68}\,a^4 = t$

Plot:



(a from −1.2 to 1.2)

Geometric figure:

line

Alternate form assuming a is real:

$1.59839\times10^{-68}\,a^4+0$

Root:

$a=0$

Polynomial discriminant:

$\Delta=0$

Property as a function:

Parity

even

Derivative:

$$\frac{d}{da}\left(1.59839\times10^{-68}\,a^4\right)=6.39356\times10^{-68}\,a^3$$

Indefinite integral:

$$\int\frac{15\,a^4\left(\frac{\left(1-0.5^2\right)\left(1+\frac{121\times0.5^2}{304}\right)^{870/2299}}{0.5^{12/19}}\right)^4 0.0194305}{304\left((6.6743\times10^{-11})^3\,(30\,1.9884\times10^{30})^2\,2\,(30\,1.9884\times10^{30})\right)}\,da=$$
$$3.19678\times10^{-69}\,a^5+\text{constant}$$

Global minimum:

$$\min\left\{1.59839\times10^{-68}\,a^4\right\} = 0 \text{ at } a = 0$$

Definite integral after subtraction of diverging parts:

$$\int_0^\infty \left(1.59839\times10^{-68}\,a^4 - 1.59839\times10^{-68}\,a^4\right) da = 0$$

From

$$\frac{15}{304}\times\frac{a^4}{(6.6743\times10^{-11})^3\,(30\times1.9884\times10^{30})^2\times2\,(30\times1.9884\times10^{30})\left(\frac{1-0.5^2}{0.5^{12/19}}\left(1+121\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305}$$

For a^4 = ((1/(1+5)*1/(2*(30*1.9884e+30))))^4

15/304 * ((((1/(1+5)*1/(2*(30*1.9884e+30))))))^4/(((6.6743e-11)^3*(30*1.9884e+30)^2*2*(30*1.9884e+30)))*[(1-0.5^2)/(0.5)^(12/19)*(1+121*0.5^2/304)^(870/2299)]^4 (0.0194305)

Input interpretation:

$$\frac{15}{304}\times\frac{\left(\frac{1}{1+5}\times\frac{1}{2\,(30\times1.9884\times10^{30})}\right)^4}{(6.6743\times10^{-11})^3\,(30\times1.9884\times10^{30})^2\times2\,(30\times1.9884\times10^{30})\left(\frac{1-0.5^2}{0.5^{12/19}}\left(1+121\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305}$$

Result:

$6.08776\ldots\times10^{-200}$

$6.08776\ldots*10^{-200} = t$

We have also that:

15/304 * ((((1/(1+5)*1/(2*(30*1.9884e+30))))))^4/(((6.6743e-11)^3*(30*1.9884e+30)^2*2*(30*1.9884e+30)))*[(1-0.5^2)/(0.5)^(12/19)*((11+0.0496)x*0.5^2/304)^(870/2299)]^4 (0.0194305) = 6.08776e-200

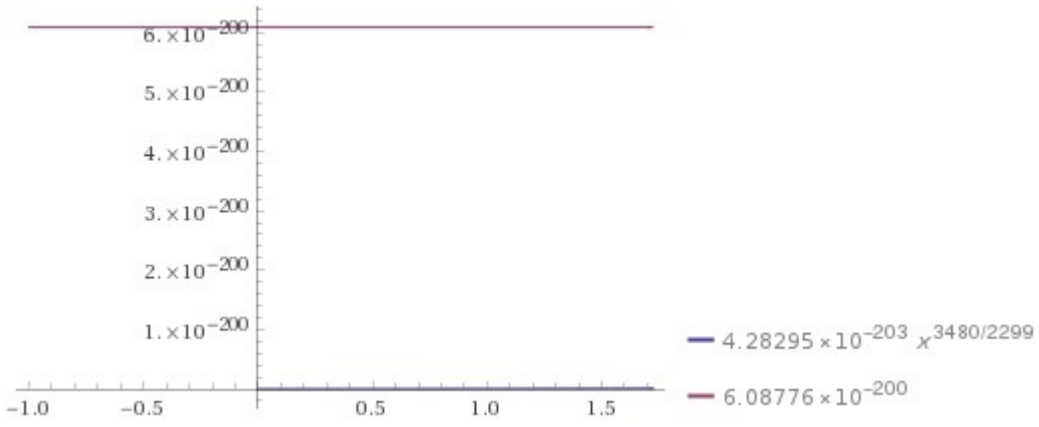
Input interpretation:

$$\frac{15}{304}\times\frac{\left(\frac{1}{1+5}\times\frac{1}{2\left(30\times1.9884\times10^{30}\right)}\right)^4}{\left(6.6743\times10^{-11}\right)^3\left(30\times1.9884\times10^{30}\right)^2\times2\left(30\times1.9884\times10^{30}\right)}\left(\frac{1-0.5^2}{0.5^{12/19}}\left((11+0.0496)\,x\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305=\frac{6.08776}{10^{200}}$$

Result:

$4.28295\times10^{-203}\,x^{3480/2299}=6.08776\times10^{-200}$

Plot:



Solution:

$x=121.$

121

And:

15/304 * ((((1/(1+5)*1/(2*(30*1.9884e+30))))))^4/(((6.6743e-11)^3*(30*1.9884e+30)^2*2*(30*1.9884e+30)))*[(1-0.5^2)/(0.5)^(12/19)*((10.696*x*0.5^2/304))^(870/2299)]^4 (0.0194305) = 6.08776e-200

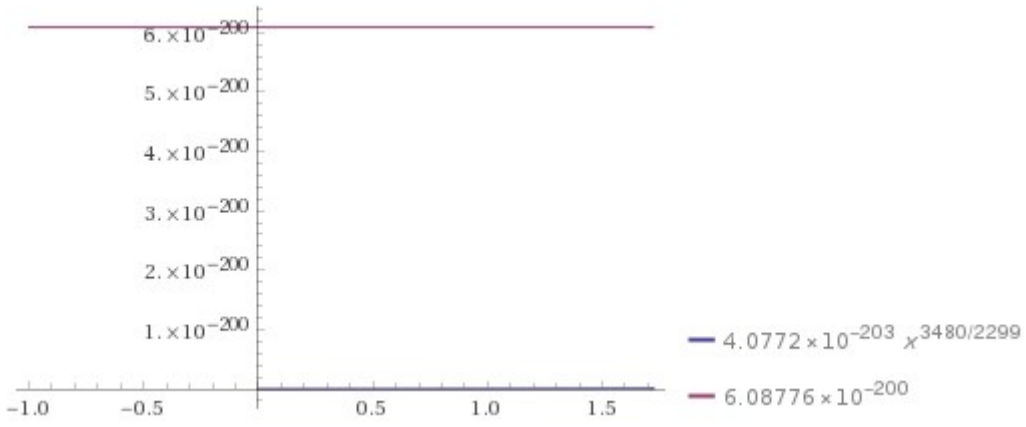
Input interpretation:

$$\frac{15}{304}\times\frac{\left(\frac{1}{1+5}\times\frac{1}{2\left(30\times1.9884\times10^{30}\right)}\right)^4}{\left(6.6743\times10^{-11}\right)^3\left(30\times1.9884\times10^{30}\right)^2\times2\left(30\times1.9884\times10^{30}\right)}\left(\frac{1-0.5^2}{0.5^{12/19}}\left(10.696\,x\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305=\frac{6.08776}{10^{200}}$$

Result:

$4.0772\times10^{-203}\,x^{3480/2299}=6.08776\times10^{-200}$

Plot:



Solution:

$x = 125.$

125 result very near to the Higgs boson mass 125.18 GeV

From which, inverting the value of magnetic current density of Planck 2.528248 × 10^{101} V/m·H :

((π^2/3 - ζ(5))) *1/(2.528248 × 10^101)^2*1728

Where 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem

Input interpretation:

$$\left(\frac{\pi^2}{3} - \zeta(5)\right) \times \frac{1}{(2.528248 \times 10^{101})^2} \times 1728$$

$\zeta(s)$ is the Riemann zeta function

Result:

$6.090516... \times 10^{-200}$

6.090516…*10^{-200}

Alternative representations:

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = \frac{1728\left(\frac{\pi^2}{3} - \zeta(5, 1)\right)}{(2.52825 \times 10^{101})^2}$$

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = \frac{1728\left(-S_{4,1}(1) + \frac{\pi^2}{3}\right)}{(2.52825 \times 10^{101})^2}$$

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = \frac{1728\left(\frac{\pi^2}{3} + \frac{\text{Li}_5(-1)}{1 - \frac{1}{2^4}}\right)}{(2.52825 \times 10^{101})^2}$$

Series representations:

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = 9.01121 \times 10^{-201}\,\pi^2 - 2.70336 \times 10^{-200} \sum_{k=1}^{\infty} \frac{1}{k^5}$$

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = 9.01121 \times 10^{-201}\,\pi^2 + 2.88359 \times 10^{-200} \sum_{k=1}^{\infty} \frac{(-1)^k}{k^5}$$

$$\frac{\left(\frac{\pi^2}{3} - \zeta(5)\right) 1728}{(2.52825 \times 10^{101})^2} = 9.01121 \times 10^{-201}\,\pi^2 - 2.79057 \times 10^{-200} \sum_{k=0}^{\infty} \frac{1}{(1+2k)^5}$$

Integral representations:

$$\frac{\left(\frac{\pi^2}{3}-\zeta(5)\right)1728}{(2.52825\times 10^{101})^2}=9.01121\times 10^{-201}\,\pi^2-\frac{2.70336\times 10^{-200}}{\Gamma(5)}\int_0^\infty \frac{t^4}{-1+e^t}\,dt$$

$$\frac{\left(\frac{\pi^2}{3}-\zeta(5)\right)1728}{(2.52825\times 10^{101})^2}=9.01121\times 10^{-201}\,\pi^2-\frac{2.88359\times 10^{-200}}{\Gamma(5)}\int_0^\infty \frac{t^4}{1+e^t}\,dt$$

$$\frac{\left(\frac{\pi^2}{3}-\zeta(5)\right)1728}{(2.52825\times 10^{101})^2}=9.01121\times 10^{-201}\,\pi^2-\frac{1.39528\times 10^{-200}}{\Gamma(5)}\int_0^\infty t^4\,\text{csch}(t)\,dt$$

Now, we have:

(((2sqrt(6) π)/7)*1/1729)*1/sqrt[15/304
((((1/(1+5)*1/(2(30*1.9884e+30))))^4/(((6.6743e-11)^3
(30*1.9884e+30)^2*2(30*1.9884e+30)))[(1-
0.5^2)/(0.5)^(12/19)(1+121*0.5^2/304)^(870/2299)]^4 (0.0194305)))]

Input interpretation:

$$\left(\left(\frac{1}{7}\left(2\sqrt{6}\,\pi\right)\right)\times\frac{1}{1729}\right)\times 1\Bigg/\left(\sqrt{\left(\frac{15}{304}\left(\frac{\left(\frac{1}{1+5}\times\frac{1}{2\left(30\times 1.9884\times 10^{30}\right)}\right)^4}{(6.6743\times 10^{-11})^3\left(30\times 1.9884\times 10^{30}\right)^2\times 2\left(30\times 1.9884\times 10^{30}\right)}\left(\frac{1-0.5^2}{0.5^{12/19}}\left(1+121\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times 0.0194305\right)\right)}\right)$$

Result:

$5.15387\ldots\times 10^{96}$

$5.15387\ldots*10^{96}$ result practically equal to the value of 5.154849 (Planck density)

And also:

colog(((15/304 * ((((1/(1+5)*1/(2*(30*1.9884e+30))))))^4/(((6.6743e-11)^3*(30*1.9884e+30)^2*2*(30*1.9884e+30)))*[(1-0.5^2)/(0.5)^(12/19)*(1+121*0.5^2/304)^(870/2299)]^4 (0.0194305))))+34+5

Input interpretation:

$$-\log\left(\frac{15}{304}\times\frac{\left(\frac{1}{1+5}\times\frac{1}{2\left(30\times1.9884\times10^{30}\right)}\right)^4}{\left(6.6743\times10^{-11}\right)^3\left(30\times1.9884\times10^{30}\right)^2\times2\left(30\times1.9884\times10^{30}\right)}\left(\frac{1-0.5^2}{0.5^{12/19}}\left(1+121\times\frac{0.5^2}{304}\right)^{870/2299}\right)^4\times0.0194305\right)+34+5$$

$\log(x)$ is the natural logarithm

Result:

497.711...

497.711…. result very near to the value of the rest mass of Kaon meson 497.614

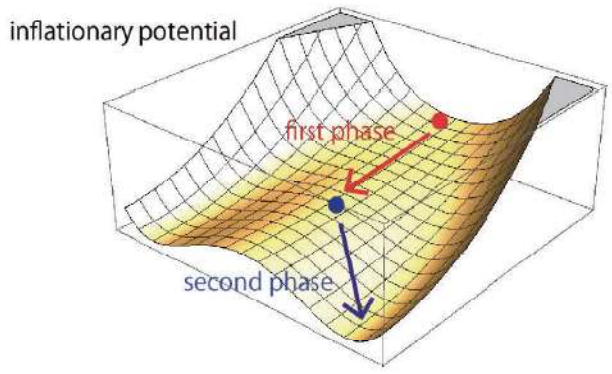


Figure 6: A schematic picture of dynamics of the double inflation based on the hybrid model

From:

Hyperbolic symmetries, inflaton-phantom cosmology, and inflation
R. Cartas-Fuentevilla, A. Escalante-Hernandez, and A. Herrera-Aguilar - R. Gonzalez-Cuaglia - arXiv:1907.03551v2 [physics.gen-ph] 10 Jan 2020

We have that:

$$V + \Delta V = (m^2 + 2M_p^2)v^2 - (m^2 - 2M_p^2)w^2 + \frac{\lambda}{6}(v^2 - w^2)^2; \tag{12}$$

since the masses in the potential (12) are necessarily different from each other, the hyperbolic symmetry is effectively broken at the level of the quadratic mass terms; note however that the quartic λ-term is maintained invariant under hyperbolic rotations. On the basis of the following analysis, this modified potential is shown in Figure 2 for certain choice of the parameters.

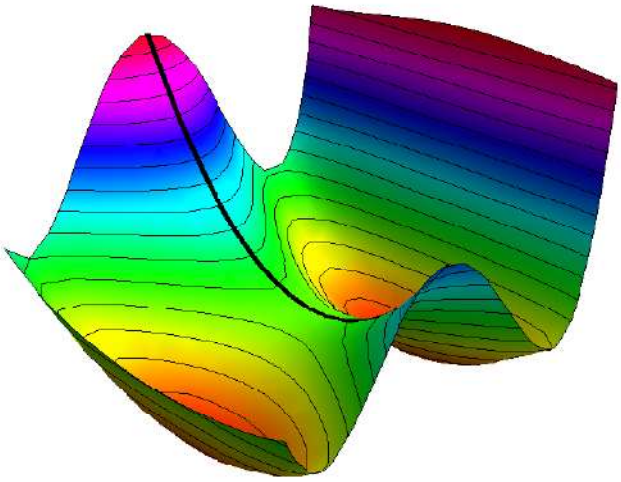
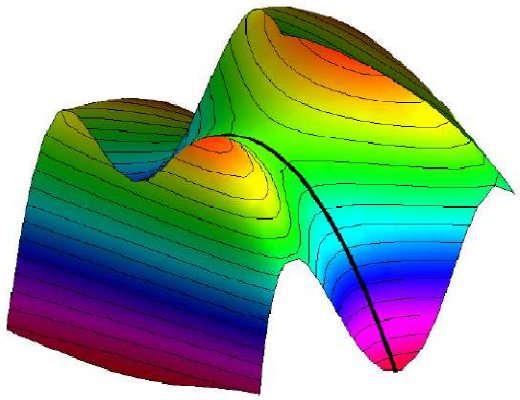


Figure 2: The potential (12); the vertices of the hyperbolic valley have been *depressed* into the *bottom* of the red regions, where stable states are localized; the black curve on the ridge represents again the critical bifurcation points.

Inverting the figure, we obtain:



From eq. (12)

$$V + \Delta V = (m^2 + 2M_p^2)v^2 - (m^2 - 2M_p^2)w^2 + \frac{\lambda}{6}(v^2 - w^2)^2;$$

For:

$m^2 > 0$, and $\lambda > 0$;

m = 3 , λ = 2

$$w_0^2 = \frac{3}{\lambda}(m^2 - 2M_p^2)),$$

$$v_0^2 = -\frac{3}{\lambda}(m^2 + 2M_p^2),$$

$$M_P = \sqrt{\frac{\hbar c}{8\pi G}} \approx 4.341 \times 10^{-9}\ \text{kg} = 2.435 \times 10^{18}\ \text{GeV}/c^2.$$

we obtain:

(3^2+2*(2.435e+18)^2)*(-3/2(3^2+2*(2.435e+18)^2)-(3^2-2*(2.435e+18)^2)*(3/2(3^2-2*(2.435e+18)^2)+2/6(3/2*3^2+3/2*3^2)

Input interpretation:

$$(3^2 + 2(2.435 \times 10^{18})^2)\left(-\frac{3}{2}(3^2 + 2(2.435 \times 10^{18})^2)\right) - (3^2 - 2(2.435 \times 10^{18})^2)\left(\frac{3}{2}(3^2 - 2(2.435 \times 10^{18})^2)\right) + \frac{2}{6}\left(\frac{3}{2} \times 3^2 + \frac{3}{2} \times 3^2\right)$$

-4.218685092075000000×10^{74}

From the above expression, performing the following integration, and for

$M_P^2 = 4.341 \times 10^{-9}$, we obtain:

integrate ((ln(3^2+2*(4.341e-9)^2)*(-3/2(3^2+2*(4.341e-9)^2))-ln(3^2-2*(4.341e-9)^2)*(3/2(3^2-2*(4.341e-9)^2))+ln(2/6(3/2*3^2+3/2*3^2)))) d^4x

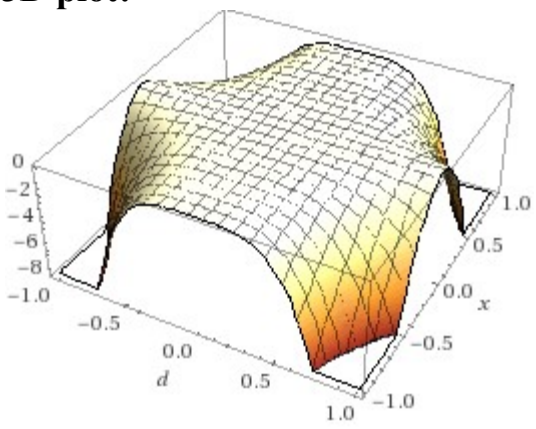
Indefinite integral:

$$\int \left(\frac{1}{2} \log(3^2 + 2(4.341 \times 10^{-9})^2)(-3(3^2 + 2(4.341 \times 10^{-9})^2)) - \frac{1}{2} \log(3^2 - 2(4.341 \times 10^{-9})^2)(3(3^2 - 2(4.341 \times 10^{-9})^2)) + \log\left(\frac{2}{6} \left(\frac{3 \times 3^2}{2} + \frac{3 \times 3^2}{2} \right) \right) \right) d^4 x \, dx = -28.5639 \, d^4 x^2 + \text{constant}$$

$\log(x)$ is the natural logarithm

28.5639

3D plot:



Or:

integrate ((ln(3^2+2*(4.341e-9)^2)*(-3/2(3^2+2*(4.341e-9)^2))-ln(3^2-2*(4.341e-9)^2)*(3/2(3^2-2*(4.341e-9)^2))+ln(2/6(3/2*3^2+3/2*3^2))))x, x = 0..1

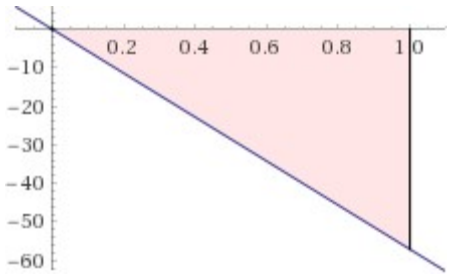
Definite integral:

$$\int_0^1 \left(\frac{1}{2}\log(3^2+2(4.341\times10^{-9})^2)(-3(3^2+2(4.341\times10^{-9})^2))-\frac{1}{2}\log(3^2-2(4.341\times10^{-9})^2)(3(3^2-2(4.341\times10^{-9})^2))+\log\left(\frac{2}{6}\left(\frac{3\times3^2}{2}+\frac{3\times3^2}{2}\right)\right)\right)x\,dx = -28.5639$$

$\log(x)$ is the natural logarithm

-28.5639

Visual representation of the integral:



Indefinite integral:

$$\int \left(\frac{1}{2}\log(3^2+2(4.341\times10^{-9})^2)(-3(3^2+2(4.341\times10^{-9})^2))-\frac{1}{2}\log(3^2-2(4.341\times10^{-9})^2)(3(3^2-2(4.341\times10^{-9})^2))+\log\left(\frac{2}{6}\left(\frac{3\times3^2}{2}+\frac{3\times3^2}{2}\right)\right)\right)x\,dx = -28.5639\,x^2 + \text{constant}$$

[integrate ((ln(3^2+2*(4.341e-9)^2)*(-3/2(3^2+2*(4.341e-9)^2))-ln(3^2-2*(4.341e-9)^2)*(3/2(3^2-2*(4.341e-9)^2))+ln(2/6(3/2*3^2+3/2*3^2))))x, x = 0..1]^1/7

Input interpretation:

$$\left(\int_0^1 \left(\log(3^2+2\,(4.341\times10^{-9})^2)\left(-\frac{3}{2}\,(3^2+2\,(4.341\times10^{-9})^2)\right)-\log(3^2-2\,(4.341\times10^{-9})^2)\left(\frac{3}{2}\,(3^2-2\,(4.341\times10^{-9})^2)\right)+\log\left(\frac{2}{6}\left(\frac{3}{2}\times3^2+\frac{3}{2}\times3^2\right)\right)\right)x\,dx\right)\text{^}(1/7)$$

$\log(x)$ is the natural logarithm

Result:

$1.4544 + 0.700402\,i$

Computation result:

$$\left(\int_0^1 \left(\frac{1}{2}\log(3^2+2\,(4.341\times10^{-9})^2)\,(-3\,(3^2+2\,(4.341\times10^{-9})^2))-\frac{1}{2}\log(3^2-2\,(4.341\times10^{-9})^2)\,(3\,(3^2-2\,(4.341\times10^{-9})^2))+\log\left(\frac{2}{6}\left(\frac{3\times3^2}{2}+\frac{3\times3^2}{2}\right)\right)\right)x\,dx\right)\text{^}(1/7)=1.4544+0.700402\,i$$

Input interpretation:

$1.4544 + 0.700402\,i$

i is the imaginary unit

Result:

1.4544... +
0.700402... i

Polar coordinates:

$r = 1.61426$ (radius), $\theta = 25.7143°$ (angle)

1.61426 result that is a good approximation to the value of the golden ratio 1.618033988749...

From:

The Quantum Theory of Fields - Volume I - Foundations
Steven Weinberg - University of Texas at Austin - First published 1995

Now, we have, with regard the Feynman rules and the calculation of the propagator, the following equations:

(f) Pairing of a field $\psi_\ell(x)$ in $\mathscr{H}_i(x)$ with a field adjoint $\psi_m^\dagger(y)$ in $\mathscr{H}_j(y)$ yields a factor*

$$\theta(x-y)\left[\psi_\ell^+(x),\psi_m^{+\dagger}(y)\right]_\mp \pm \theta(y-x)\left[\psi_m^{-\dagger}(y),\psi_\ell^-(x)\right]_\mp \equiv -i\,\Delta_{\ell m}(x,y)\,, \tag{6.1.14}$$

where ψ^+ and ψ^- are the terms in ψ that destroy particles and create antiparticles, respectively:

$$\psi_\ell^+(x) = (2\pi)^{-3/2}\int d^3p \sum_\sigma u_\ell(\mathbf{p}\,\sigma\,n)\,e^{ip\cdot x}a(\mathbf{p}\,\sigma\,n)\,, \tag{6.1.15}$$

$$\psi_\ell^-(x) = (2\pi)^{-3/2}\int d^3p \sum_\sigma v_\ell(\mathbf{p}\,\sigma\,n)\,e^{-ip\cdot x}a^\dagger(\mathbf{p}\,\sigma\,n^c)\,. \tag{6.1.16}$$

We now turn to a calculation of the propagator (6.1.14), an essential ingredient in the Feynman rules that arises in the pairing of a field $\psi_\ell(x)$ with a field adjoint $\psi_m^\dagger(y)$. Inserting Eqs. (6.1.15) and (6.1.16) in Eq. (6.1.14), and using the commutation or anticommutation relations for annihilation and creation operators, we have immediately

$$-i\Delta_{\ell m}(x,y) = \theta(x-y)(2\pi)^{-3/2}\int d^3p \sum_\sigma u_\ell(\mathbf{p}\,\sigma\,n)u_m^*(\mathbf{p}\,\sigma\,n)e^{ip\cdot(x-y)} \pm \theta(y-x)(2\pi)^{-3/2}\int d^3p \sum_\sigma v_m^*(\mathbf{p}\,\sigma\,n)v_\ell(\mathbf{p}\,\sigma\,n)e^{ip\cdot(y-x)}\,. \tag{6.2.1}$$

It will be most useful to use the expression of the Feynman propagator as a Fourier integral. The step functions in Eq. (6.2.13) have the Fourier representation*

$$\theta(t) = \frac{-\mathbf{i}}{2\pi i}\int_{-\infty}^{\infty} \frac{\exp(-ist)}{s+i\epsilon}\,ds\,. \tag{6.2.15}$$

This can be combined with the Fourier integral (6.2.9) for $\Delta_+(x)$. We introduce new integration variables, $\mathbf{q} \equiv \mathbf{p}$, $q^0 = p^0 + s$ in the first term of Eq. (6.2.13), yielding

$$-i\Delta_F(x) - -\frac{1}{2\pi i}\int d^3q \int_{-\infty}^{\infty} dq^0\, \frac{\exp(i\mathbf{q}\cdot\mathbf{x} - iq^0x^0)}{(2\pi)^3\sqrt{2\sqrt{\mathbf{q}^2+m^2}}}$$
$$\times\left[\left(q^0 - \sqrt{\mathbf{q}^2+m^2} - i\epsilon\right)^{-1} + \left(-q^0 - \sqrt{\mathbf{q}^2+m^2} - i\epsilon\right)^{-1}\right].$$

Combining denominators and adopting a four-dimensional notation, we have simply

$$\Delta_F(x) = (2\pi)^{-4}\int d^4q\, \frac{\exp(iq\cdot x)}{q^2+m^2-i\epsilon}\,, \tag{6.2.16}$$

where $q^2 \equiv \mathbf{q}^2 - (q^0)^2$. (In the denominator we have replaced $2\epsilon\sqrt{\mathbf{q}^2+m^2}$ with ϵ, because the only important thing about this quantity is that it is a positive infinitesimal.) This shows incidentally that Δ_F is a Green's function for the Klein–Gordon differential operator, in the sense that

$$(\Box - m^2)\Delta_F(x) = -\delta^4(x) \tag{6.2.17}$$

with boundary conditions specified by the $-i\epsilon$ in the denominator: as shown by Eq. (6.2.13), $\Delta_F(x)$ for $x^0 \to +\infty$ or $x^0 \to -\infty$ involves only positive or negative frequency terms, $\exp(-ix^0\sqrt{\mathbf{p}^2+m^2})$ or $\exp(+ix^0\sqrt{\mathbf{p}^2+m^2})$, respectively.

Inserting Eq. (6.2.16) in Eq. (6.2.14) now gives the propagator as

$$\Delta_{\ell m}(x,y) = (2\pi)^{-4}\int d^4q\, \frac{P^{(L)}_{\ell m}(q)e^{iq\cdot(x-y)}}{q^2+m^2-i\epsilon}\,. \tag{6.2.18}$$

From:

$$\Delta_F(x) = (2\pi)^{-4} \int d^4q \; \frac{\exp(iq \cdot x)}{q^2 + m^2 - ie},$$

we obtain:

(1/(2Pi)^4) * integrate(1.28e-30 * ((exp(i*1.28e-30)))/((((1.28e-30)^2-(0.0416667)^2)+ (9.1093837e-31)^2-i*1/24)))d^4x

Input interpretation:

$$\frac{1}{(2\pi)^4} \int\int \left(1.28 \times 10^{-30} \times \frac{\exp(i \times 1.28 \times 10^{-30})}{((1.28 \times 10^{-30})^2 - 0.0416667^2) + (9.1093837 \times 10^{-31})^2 - i \times \frac{1}{24}}\right) d^4x \, dx$$

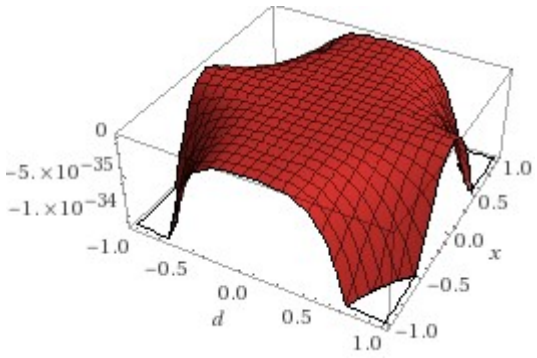
i is the imaginary unit

Result:

$$(-4.09928 \times 10^{-34} + 9.83826 \times 10^{-33}\, i)\, d^4\, x^2$$

3D plots:

Real part



We note that the plots are very similar: it is possible another mathematical and physical connection?

(-4.09928×10^-34 + 9.83826×10^-33 i)

Input interpretation:

$-4.09928 \times 10^{-34} + 9.83826 \times 10^{-33}\, i$

$-4.09928*10^{-34} + 9.83826*10^{-33} i$

Result:

$-4.09928... \times 10^{-34} + 9.83826... \times 10^{-33}\, i$

Polar coordinates:

$r = 9.8468 \times 10^{-33}$ (radius), $\theta = 92.3859°$ (angle)

$9.8468*10^{-33}$

Furthermore, from the above solution, we obtain also:

1/3 * ln((1/(-4.09928×10^-34 + 9.83826×10^-33 i)))+4

Input interpretation:

$\frac{1}{3} \log\left(\frac{1}{-4.09928 \times 10^{-34} + 9.83826 \times 10^{-33}\, i}\right) + 4$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

$28.56605... - 0.5374797...\, i$

Polar coordinates:

$r = 28.5711$ (radius), $\theta = -1.07791°$ (angle)

28.5711

We observe that:

(((1/3 * ln((1/(-4.09928×10^-34 + 9.83826×10^-33 i)))+4)))^1/7

Input interpretation:

$$\sqrt[7]{\frac{1}{3}\log\left(\frac{1}{-4.09928\times10^{-34}+9.83826\times10^{-33}\,i}\right)+4}$$

$\log(x)$ is the natural logarithm

i is the imaginary unit

Result:

1.6143140... –
0.0043386194... i

Polar coordinates:

$r = 1.61432$ (radius), $\theta = -0.153987°$ (angle)

1.61432 result that is a very good approximation to the value of the golden ratio 1.618033988749...

On Climbing Scalars in String Theory

E. Dudas, N. Kitazawa and A. Sagnotti - arXiv:1009.0874v1 [hep-th] 4 Sep 2010

From:

$$V = \frac{c}{8}\,e^{-2x} + \frac{b}{2}\,e^{-\frac{4x}{3}-b\,e^{\frac{2x}{3}}}\left[(Re\;a\overline{W_0})\cos\frac{2by}{3} + (Im\;a\overline{W_0})\sin\frac{2by}{3} + \frac{|a|^2}{3}\left(3+b\,e^{\frac{2x}{3}}\right)\,e^{-b\,e^{\frac{2x}{3}}}\right]. \qquad (3.8)$$

For a = 2, b = 3 and c = 5, we obtain:

5/8 exp(-2Pi) + 3/2 exp(((-4Pi)/3) - 3 exp((2Pi)/3)) [2 cos(2) + 2*i sin (2) +4/3 (3+3*exp((2Pi)/3)) exp(-3 exp((2Pi)/3))]

Input:

$$\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(\frac{1}{3}(-4\pi)-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2\,i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)$$

i is the imaginary unit

Exact result:

$$\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,i\sin(2)+2\cos(2)\right)$$

Decimal approximation:

$0.00116715170681964283364401591804843703388509496977507\ldots +$
$1.08782248037971654043472324954380586895939102313011\ldots \times 10^{-12}\ i$

Polar coordinates:

$r \approx 0.00116715$ (radius), $\theta \approx 5.34015\times 10^{-8}{}^\circ$ (angle)
0.00116715

Alternate forms:

$$\frac{5\,e^{-2\pi}}{8}+3\,e^{-6\,e^{(2\pi)/3}-(4\pi)/3}\left(2+2\,e^{(2\pi)/3}+e^{3\,e^{(2\pi)/3}}\,(\cos(2)+i\sin(2))\right)$$

$$\frac{1}{8}\left(5\,e^{-2\pi}+24\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(2\,e^{-3\,e^{(2\pi)/3}}\left(1+e^{(2\pi)/3}\right)+i\sin(2)+\cos(2)\right)\right)$$

$$6\,e^{-6\,e^{(2\pi)/3}-(4\pi)/3}+3\,e^{2\,i-3\,e^{(2\pi)/3}-(4\pi)/3}+6\,e^{-6\,e^{(2\pi)/3}-(2\pi)/3}+\frac{5\,e^{-2\pi}}{8}$$

Alternative representations:

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2\,i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cosh(-2\,i)+2\,i\cos\left(-2+\frac{\pi}{2}\right)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)+\frac{5}{8}\exp(-2\pi)$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2\,i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cosh(-2\,i)-2\,i\cos\left(2+\frac{\pi}{2}\right)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)+\frac{5}{8}\exp(-2\pi)$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cosh(2i)+2i\cos\left(-2+\frac{\pi}{2}\right)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)+\frac{5}{8}\exp(-2\pi)$$

Series representations:

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\sum_{k=0}^{\infty}\frac{3(-1)^k e^{-3e^{(2\pi)/3}-(4\pi)/3}\left(4^k+i\left(2-\frac{\pi}{2}\right)^{2k}\right)}{(2k)!}$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\sum_{k=0}^{\infty}\frac{3(-4)^k e^{-3e^{(2\pi)/3}-(4\pi)/3}(2i(2k)!+(1+2k)!)}{(2k)!(1+2k)!}$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\sum_{k=0}^{\infty}\frac{3(-1)^k e^{-3e^{(2\pi)/3}-(4\pi)/3}\left(4i\left(4^k+i\left(2-\frac{\pi}{2}\right)^{2k}\right)+\left(2-\frac{\pi}{2}\right)^{2k}\pi\right)}{2(1+2k)!}$$

Integral representations:

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=$$
$$6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{3e^{-3e^{(2\pi)/3}-(4\pi)/3-1/s+s}(1-is)}{2\sqrt{\pi}\,s^{3/2}}ds\quad\text{for }\gamma>0$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=$$
$$6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{3e^{-3e^{(2\pi)/3}-(4\pi)/3-1/s}\left(-ie^{s}\,\Gamma\left(\frac{3}{2}-s\right)+\sqrt[s]{e}\,\sqrt{s}\,\Gamma(s)\right)}{2\sqrt{\pi}\,\sqrt{s}\,\Gamma\left(\frac{3}{2}-s\right)}ds\quad\text{for }0<\gamma<1$$

$$\frac{1}{8}\exp(-2\pi)5+\frac{1}{2}\left(\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)3=$$
$$6e^{-6e^{(2\pi)/3}-(4\pi)/3}+6e^{-6e^{(2\pi)/3}-(2\pi)/3}+\frac{5e^{-2\pi}}{8}+\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{3e^{-3e^{(2\pi)/3}-(4\pi)/3-1/s}\left(e^{s}\,\Gamma\left(\frac{1}{2}-s\right)-i\sqrt[s]{e}\,s^{3/2}\,\Gamma(s)\right)}{2\sqrt{\pi}\,s^{3/2}\,\Gamma\left(\frac{1}{2}-s\right)}ds\quad\text{for }0<\gamma<\frac{1}{2}$$

From which:

sqrt((1/[5/8 exp(-2Pi) + 3/2 exp(((-4Pi)/3) - 3 exp((2Pi)/3)) [2 cos(2) + 2*i sin (2) +4/3 (3+3*exp((2Pi)/3)) exp(-3 exp((2Pi)/3))]]))

Input:

$$\sqrt{\left(1\Big/\left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(\frac{1}{3}(-4\pi)-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)\right)}$$

i is the imaginary unit

Exact result:

$$\frac{1}{\sqrt{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,i\sin(2)+2\cos(2)\right)}}$$

Decimal approximation:

29.270918147627127487699157601553634916719865726547 36... –
1.364071294086870592760736286784296713082357022486349... × 10^{-8} i

Polar coordinates:

$r \approx 29.2709$ (radius), $\theta \approx -2.67007\times10^{-8}{}^\circ$ (angle)
29.2709

Alternate forms:

$$\frac{1}{\sqrt{\frac{5\,e^{-2\pi}}{8}+3\,e^{-6\,e^{(2\pi)/3}-(4\pi)/3}\left(2+2\,e^{(2\pi)/3}+e^{3\,e^{(2\pi)/3}}\left(\cos(2)+i\sin(2)\right)\right)}}$$

$$\frac{1}{\sqrt{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,e^{2i}\right)}}$$

$$\frac{2}{\sqrt{\frac{1}{2}\left(5\,e^{-2\pi}+24\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(2\,e^{-3\,e^{(2\pi)/3}}\left(1+e^{(2\pi)/3}\right)+i\sin(2)+\cos(2)\right)\right)}}$$

and:

((sqrt((1/[5/8 exp(-2Pi) + 3/2 exp(((-4Pi)/3) - 3 exp((2Pi)/3)) [2 cos(2) + 2*i sin (2) +4/3 (3+3*exp((2Pi)/3)) exp(-3 exp((2Pi)/3))]])))^1/7

Input:

$$\left(\sqrt{\left(1\Big/\left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(\frac{1}{3}(-4\pi)-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2\,i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)\right)}\right)\,\hat{}\,(1/7)$$

i is the imaginary unit

Exact result:

$$\frac{1}{\sqrt[14]{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,i\sin(2)+2\cos(2)\right)}}$$

Decimal approximation:

1.619910074841613108178965060967842392477523579123 08... –
1.078434047917034013204450501268111280460493362769 64... × 10^{-10} i

Polar coordinates:

$r \approx 1.61991$ (radius), $\theta \approx -3.81439 \times 10^{-9}{}^{\circ}$ (angle)

1.61991 result that is a good approximation to the value of the golden ratio 1.618033988749...

Alternate forms:

$$\frac{1}{\sqrt[14]{\frac{5\,e^{-2\pi}}{8}+3\,e^{-6\,e^{(2\pi)/3}-(4\pi)/3}\left(2+2\,e^{(2\pi)/3}+e^{3\,e^{(2\pi)/3}}\left(\cos(2)+i\sin(2)\right)\right)}}$$

$$\frac{1}{\sqrt[14]{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,e^{2i}\right)}}$$

$$\frac{2^{3/14}}{\sqrt[14]{5\,e^{-2\pi}+24\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(2\,e^{-3\,e^{(2\pi)/3}}\left(1+e^{(2\pi)/3}\right)+i\sin(2)+\cos(2)\right)}}$$

We have also:

integrate(((5/8 exp(-2Pi) + 3/2 exp(((-4Pi)/3) - 3 exp((2Pi)/3)) [2 cos(2) + 2*i sin (2) +4/3 (3+3*exp((2Pi)/3)) exp(-3 exp((2Pi)/3))]))x. x=0..1

Definite integral:

$$\int_0^1 \left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)x\,dx = \frac{1}{2}\left(\frac{5e^{-2\pi}}{8}+\frac{3}{2}e^{-3e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}e^{-3e^{(2\pi)/3}}\left(3+3e^{(2\pi)/3}\right)+2i\sin(2)+2\cos(2)\right)\right)\approx 0.0005836+5.44\times10^{-13}\,i$$

i is the imaginary unit

Indefinite integral:

$$\int \left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)x\,dx = \frac{5}{16}e^{-2\pi}x^2+\frac{3}{4}e^{-3e^{(2\pi)/3}-(4\pi)/3}x^2\left(\frac{4}{3}e^{-3e^{(2\pi)/3}}\left(3+3e^{(2\pi)/3}\right)+2i\sin(2)+2\cos(2)\right)+ \text{constant}$$

Input interpretation:

$0.0005836+5.44\times10^{-13}\,i$

i is the imaginary unit

Result:

$0.0005836\ldots +$
$5.44\ldots\times10^{-13}\,i$

Polar coordinates:

$r = 0.0005836$ (radius), $\theta = 5.3408\times10^{-8\circ}$ (angle)

0.0005836

1/ integrate(((5/8 exp(-2Pi) + 3/2 exp(((-4Pi)/3) - 3 exp((2Pi)/3)) [2 cos(2) + 2*i sin (2) +4/3 (3+3*exp((2Pi)/3)) exp(-3 exp((2Pi)/3))]))x. x=0..1

Input:

$$1\Big/\left(\int_0^1 \left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(\frac{1}{3}(-4\pi)-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)x\,dx\right)$$

i is the imaginary unit

Result:

$$\frac{2}{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,i\sin(2)+2\cos(2)\right)}\approx$$
$$1713.57-1.5971\times10^{-6}\,i$$

Computation result:

$$1\Big/\left(\int_0^1\left(\frac{5}{8}\exp(-2\pi)+\frac{3}{2}\exp\left(-\frac{4\pi}{3}-3\exp\left(\frac{2\pi}{3}\right)\right)\left(2\cos(2)+2\,i\sin(2)+\frac{4}{3}\left(3+3\exp\left(\frac{2\pi}{3}\right)\right)\exp\left(-3\exp\left(\frac{2\pi}{3}\right)\right)\right)\right)x\,dx\right)=$$
$$\frac{2}{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,i\sin(2)+2\cos(2)\right)}$$

Alternate forms:

$$\frac{16}{5\,e^{-2\pi}+24\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(2\,e^{-3\,e^{(2\pi)/3}}\left(1+e^{(2\pi)/3}\right)+i\sin(2)+\cos(2)\right)}$$

$$\frac{2}{\frac{5\,e^{-2\pi}}{8}+3\,e^{-6\,e^{(2\pi)/3}-(4\pi)/3}\left(2+2\,e^{(2\pi)/3}+e^{3\,e^{(2\pi)/3}}\left(\cos(2)+i\sin(2)\right)\right)}$$

$$\frac{2}{\frac{5\,e^{-2\pi}}{8}+\frac{3}{2}\,e^{-3\,e^{(2\pi)/3}-(4\pi)/3}\left(\frac{4}{3}\,e^{-3\,e^{(2\pi)/3}}\left(3+3\,e^{(2\pi)/3}\right)+2\,e^{2i}\right)}$$

Input interpretation:

$1713.57-1.5971\times10^{-6}\,i$

i is the imaginary unit

Result:

1713.57... −
1.5971... $\times10^{-6}\,i$

Polar coordinates:

$r=1713.57$ (radius), $\theta=-5.34014\times10^{-8}{}^\circ$ (angle)

1713.57 result in the range of the mass of candidate "glueball" $f_0(1710)$ ("glueball" =1760 ± 15 MeV).

1/64(1713.57 - 1.5971×10^-6 i)+2

Input interpretation:

$$\frac{1}{64}\left(1713.57 - 1.5971 \times 10^{-6}\, i\right) + 2$$

i is the imaginary unit

Result:

$$28.7745\ldots - 2.49547\ldots \times 10^{-8}\, i$$

Polar coordinates:

$r = 28.7745$ (radius), $\theta = -4.96897 \times 10^{-8}{}^\circ$ (angle)

28.7745

From the formula of coefficients of the '5th order' mock theta function $\psi_1(q)$: (A053261 OEIS Sequence)

sqrt(golden ratio) * exp(Pi*sqrt(n/15)) / (2*5^(1/4)*sqrt(n)) for n = 59, we obtain:

sqrt(golden ratio) * exp(Pi*sqrt(59/15)) / (2*5^(1/4)*sqrt(59)) +1/golden ratio

Input:

$$\sqrt{\phi} \times \frac{\exp\left(\pi \sqrt{\frac{59}{15}}\right)}{2\sqrt[4]{5}\,\sqrt{59}} + \frac{1}{\phi}$$

ϕ is the golden ratio

Exact result:

$$\frac{e^{\sqrt{59/15}\,\pi}\sqrt{\frac{\phi}{59}}}{2\sqrt[4]{5}} + \frac{1}{\phi}$$

Decimal approximation:

28.750828439570009528920046402353187829821010214215805149 96…

28.750828…

Property:

$$\frac{e^{\sqrt{59/15}\,\pi}\sqrt{\frac{\phi}{59}}}{2\sqrt[4]{5}}+\frac{1}{\phi}\text{ is a transcendental number}$$

Alternate forms:

$$\frac{1}{2}\left(\sqrt{5}-1\right)+\frac{1}{2}\sqrt{\frac{1}{590}\left(5+\sqrt{5}\right)}\,e^{\sqrt{59/15}\,\pi}$$

$$\frac{e^{\sqrt{59/15}\,\pi}\,\phi^{3/2}+2\sqrt[4]{5}\,\sqrt{59}}{2\sqrt[4]{5}\,\sqrt{59}\,\phi}$$

$$\frac{2}{1+\sqrt{5}}+\frac{\sqrt{\frac{1}{118}\left(1+\sqrt{5}\right)}\,e^{\sqrt{59/15}\,\pi}}{2\sqrt[4]{5}}$$

Series representations:

$$\frac{\sqrt{\phi}\,\exp\left(\pi\sqrt{\frac{59}{15}}\right)}{2\sqrt[4]{5}\,\sqrt{59}}+\frac{1}{\phi}=\left(10\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(59-z_0)^k\,z_0^{-k}}{k!}+5^{3/4}\,\phi\exp\left(\pi\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{59}{15}-z_0\right)^k z_0^{-k}}{k!}\right)\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(\phi-z_0)^k\,z_0^{-k}}{k!}\right)\Bigg/\left(10\,\phi\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(59-z_0)^k\,z_0^{-k}}{k!}\right)\text{ for }\left(\text{not }\left(z_0\in\mathbb{R}\text{ and }-\infty<z_0\le 0\right)\right)$$

$$\frac{\sqrt{\phi}\ \exp\left(\pi\sqrt{\frac{59}{15}}\right)}{2\sqrt[4]{5}\ \sqrt{59}}+\frac{1}{\phi}=$$
$$\left(10\exp\left(i\pi\left\lfloor\frac{\arg(59-x)}{2\pi}\right\rfloor\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(59-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}+5^{3/4}\,\phi\exp\left(i\pi\left\lfloor\frac{\arg(\phi-x)}{2\pi}\right\rfloor\right)\right.$$
$$\exp\left(\pi\exp\left(i\pi\left\lfloor\frac{\arg\left(\frac{59}{15}-x\right)}{2\pi}\right\rfloor\right)\sqrt{x}\ \sum_{k=0}^{\infty}\frac{(-1)^k\left(\frac{59}{15}-x\right)^k x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)$$
$$\left.\sum_{k=0}^{\infty}\frac{(-1)^k\,(\phi-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\Big/$$
$$\left(10\,\phi\exp\left(i\pi\left\lfloor\frac{\arg(59-x)}{2\pi}\right\rfloor\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(59-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\quad\text{for}\ (x\in\mathbb{R}\ \text{and}\ x<0)$$

$$\frac{\sqrt{\phi}\ \exp\left(\pi\sqrt{\frac{59}{15}}\right)}{2\sqrt[4]{5}\ \sqrt{59}}+\frac{1}{\phi}=\left(\left(\frac{1}{z_0}\right)^{-1/2\,[\arg(59-z_0)/(2\pi)]}\ z_0^{-1/2\,[\arg(59-z_0)/(2\pi)]}\right.$$
$$\left(10\left(\frac{1}{z_0}\right)^{1/2\,[\arg(59-z_0)/(2\pi)]}\ z_0^{1/2\,[\arg(59-z_0)/(2\pi)]}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(59-z_0)^k\,z_0^{-k}}{k!}+\right.$$
$$5^{3/4}\,\phi\exp\left(\pi\left(\frac{1}{z_0}\right)^{1/2\left\lfloor\arg\left(\frac{59}{15}-z_0\right)/(2\pi)\right\rfloor}\ z_0^{1/2\left(1+\left\lfloor\arg\left(\frac{59}{15}-z_0\right)/(2\pi)\right\rfloor\right)}\right.$$
$$\left.\left.\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{59}{15}-z_0\right)^k z_0^{-k}}{k!}\right)\left(\frac{1}{z_0}\right)^{1/2\,[\arg(\phi-z_0)/(2\pi)]}\right.$$
$$\left.z_0^{1/2\,[\arg(\phi-z_0)/(2\pi)]}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(\phi-z_0)^k\,z_0^{-k}}{k!}\right)\Big/$$
$$\left.\left(10\,\phi\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(59-z_0)^k\,z_0^{-k}}{k!}\right)\right.$$

From the following Ramanujan's class invariant $Q=\left(G_{505}/G_{101/5}\right)^3$ = 1164.2696, we obtain, performing the 14th root, 1.65578...

Indeed:

From:

$$G_{505} = P^{-1/4}Q^{1/6} = (\sqrt{5}+2)^{1/2}\left(\frac{\sqrt{5}+1}{2}\right)^{1/4}(\sqrt{101}+10)^{1/4} \times \left((130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}}\right)^{1/6}.$$

Thus, it remains to show that

$$(130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}} = \left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3,$$

which is straightforward. □

$$\sqrt[14]{\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3} = 1{,}65578\ldots \Rightarrow$$

That is:

(((((((sqrt(((113+5sqrt(505))/8)) + sqrt(((105+5sqrt(505))/8))))))^3))))

From which:

1/41(((((((sqrt(((113+5sqrt(505))/8)) + sqrt(((105+5sqrt(505))/8))))))^3))))

Input:

$$\frac{1}{41}\left(\sqrt{\frac{1}{8}\left(113+5\sqrt{505}\right)}+\sqrt{\frac{1}{8}\left(105+5\sqrt{505}\right)}\right)^3$$

Result:

$$\frac{1}{41}\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^3$$

Decimal approximation:

28.396819543106455307069926195384856799038646331633296168 01...

28.396819…

Alternate forms:

$$\frac{\left(5\sqrt{10\left(21+\sqrt{505}\right)}+25\sqrt{5}+5\sqrt{101}\right)^3}{328\,000}$$

$$\frac{\left(5\sqrt{5}+\sqrt{101}+\sqrt{105-40\,i}+\sqrt{105+40\,i}\right)^3}{2624}$$

$$\frac{\left(5\sqrt{5}+\sqrt{101}+\sqrt{10\left(21+\sqrt{505}\right)}\right)^3}{2624}$$

Minimal polynomial:

$$7\,984\,925\,229\,121\,x^8 - 6\,438\,880\,301\,177\,284\,x^6 + 1\,132\,129\,841\,606\,x^4 - 2\,278\,635\,844\,x^2 + 1$$

With regard the numbers 28 and 29, we have:

From:

STRING THEORY VOLUME II - Superstring Theory and Beyond - *JOSEPH POLCHINSKI* - Institute for Theoretical Physics - University of California at Santa Barbara - © Cambridge University Press 2001, 2005

We have that:

> The left-movers are given with their $SO(8) \times SO(32)$ quantum numbers and the right-movers with their $SO(8)$ quantum numbers. Closed string states combine left- and right-moving states at the same mass. The left-moving side, like the bosonic string, has a would-be tachyon, but there is no right-mover to pair it with so the theory is tachyon-free. At the massless level, the product
>
> $$(\mathbf{8}_v, \mathbf{1}) \times (\mathbf{8}_v + \mathbf{8}) = (\mathbf{1}, \mathbf{1}) + (\mathbf{28}, \mathbf{1}) + (\mathbf{35}, \mathbf{1}) + (\mathbf{56}, \mathbf{1}) + (\mathbf{8}', \mathbf{1}) \qquad (11.2.17)$$
>
> is the type I supergravity multiplet.

that it is no longer equal to the spin connection. For the $E_8 \times E_8$ theory these hypermultiplets lie in the representations

$$(\mathbf{56}, \mathbf{1})^{10} + (\mathbf{1}, \mathbf{1})^{65} \tag{19.8.9}$$

of $E_7 \times E_8$. For the $SO(32)$ theory they lie in

$$(\mathbf{28}, \mathbf{2})^{10} + (\mathbf{1}, \mathbf{1})^{65} \tag{19.8.10}$$

of $SO(28) \times SU(2)$. Let us mention another result from the analysis of anomalies. A necessary condition for anomaly cancellation is that the numbers of hyper, tensor, and vector multiplets satisfy

$$n_H + 29 n_T - n_V = 273 \,. \tag{19.8.11}$$

In both of the present theories this is $625 + 29 - 381 = 273$. The full story of anomaly cancellation is more involved, because of the possibility of multiple tensors, and is left to the references.

The potential for the charged hypermultiplets has flat directions, and there is a nice geometric description of the resulting moduli space. The

We note that:

(29)^1/7

Input:

$\sqrt[7]{29}$

Decimal approximation:

1.617759652287903578576219281278612146130599835129709217819...

1.61775965…. result that is a good approximation to the value of the golden ratio 1.618033988749...

And:

((28+29)/2)^1/7

Input:

$\sqrt[7]{\frac{28+29}{2}}$

Result:

$$\sqrt[7]{\frac{57}{2}}$$

Decimal approximation:

1.613745261350790483253484867987948059902684910809045104092...

1.61374526…. result that is a good approximation to the value of the golden ratio 1.618033988749...

Now, we have that:

(from: **On Climbing Scalars in String Theory**
E. Dudas, N. Kitazawa and A. Sagnotti - arXiv:1009.0874v1 [hep-th] 4 Sep 2010)

In adapting eqs. (3.2) and (3.3) to the four dimensional KKLT system [18], the complex field T is to be expanded according to

$$T = e^{\frac{\Phi_t}{\sqrt{3}}} + i\,\frac{\theta}{\sqrt{3}}\,, \tag{3.4}$$

For:

$$\Phi_t = \frac{2}{\sqrt{3}}\,x\,, \quad \theta = \frac{2}{\sqrt{3}}\,y$$

T = exp(2/3) + i*2/3

Input:

$$\exp\left(\frac{2}{3}\right) + i \times \frac{2}{3}$$

i is the imaginary unit

Exact result:

$$e^{2/3} + \frac{2\,i}{3}$$

Decimal approximation:

1.947734041054675856639021207928345314359604087182972187 0... +
0.666666666666666666666666666666666666666666666666666666... i

Property:

$\frac{2i}{3} + e^{2/3}$ is a transcendental number

Polar coordinates:

$r \approx 2.05867$ (radius), $\theta \approx 18.895°$ (angle)

T = 2.05867

Alternate form:

$\frac{1}{3}\left(3e^{2/3} + 2i\right)$

Series representations:

$$\exp\left(\frac{2}{3}\right) + \frac{i\,2}{3} = \frac{2i}{3} + \left(\sum_{k=0}^{\infty} \frac{1}{k!}\right)^{2/3}$$

$$\exp\left(\frac{2}{3}\right) + \frac{i\,2}{3} = \frac{2i}{3} + \left(\sum_{k=0}^{\infty} \frac{(-1+k)^2}{k!}\right)^{2/3}$$

$$\exp\left(\frac{2}{3}\right) + \frac{i\,2}{3} = \frac{2i}{3} + \frac{\left(\sum_{k=0}^{\infty} \frac{1+k}{k!}\right)^{2/3}}{2^{2/3}}$$

Now, we have that:

((exp(2/3) + i*2/3))^6-13i-(2/5)i

Input:

$$\left(\exp\left(\frac{2}{3}\right) + i \times \frac{2}{3}\right)^6 - 13i - \frac{2}{5}i$$

i is the imaginary unit

Exact result:

$$-\frac{67\,i}{5}+\left(e^{2/3}+\frac{2\,i}{3}\right)^6$$

Decimal approximation:

$-30.195251297326023616088596112976539315903272091324414855\ldots +$
$56.478450826756229605346676811102337322098372187973138793\ldots\ i$

Property:

$-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+e^{2/3}\right)^6$ is a transcendental number

Polar coordinates:

$r \approx 64.0435$ (radius), $\theta \approx 118.13°$ (angle)

64.0435

Alternate forms:

$$\frac{1}{3645}\left((-320-48\,843\,i)+2880\,i\,e^{2/3}+10\,800\,e^{4/3}-21\,600\,i\,e^2-24\,300\,e^{8/3}+14\,580\,i\,e^{10/3}+3645\,e^4\right)$$

$$\left(-\frac{64}{729}-\frac{67\,i}{5}\right)+\frac{64}{81}\,i\,e^{2/3}+\frac{80\,e^{4/3}}{27}-\frac{160\,i\,e^2}{27}-\frac{20\,e^{8/3}}{3}+4\,i\,e^{10/3}+e^4$$

$$-\frac{64}{729}+\frac{80\,e^{4/3}}{27}-\frac{20\,e^{8/3}}{3}+e^4+i\left(-\frac{67}{5}+\frac{64\,e^{2/3}}{81}-\frac{160\,e^2}{27}+4\,e^{10/3}\right)$$

Series representations:

$$\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^6-i\,13-\frac{i\,2}{5}=-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{2/3}\right)^6$$

$$\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^6-i\,13-\frac{i\,2}{5}=-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}\right)^{2/3}\right)^6$$

$$\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^6-i\,13-\frac{i\,2}{5}=-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{1+2\,k}{(2\,k)!}\right)^{2/3}\right)^6$$

((([((exp(2/3) + i*2/3))^6-13i-(2/5)i]^2)))+8+2

Input:

$$\left(\left(\exp\left(\frac{2}{3}\right)+i\times\frac{2}{3}\right)^6-13\,i-\frac{2}{5}\,i\right)^2+8+2$$

i is the imaginary unit

Exact result:

$$10+\left(-\frac{67\,i}{5}+\left(e^{2/3}+\frac{2\,i}{3}\right)^6\right)^2$$

Decimal approximation:

$-2268.062206881652523191837314039942990236120518955541067 0\ldots -$
$3410.762031195150146126590135703452533561622886063412662 6\ldots\,i$

Property:

$10+\left(-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+e^{2/3}\right)^6\right)^2$ is a transcendental number

Polar coordinates:

$r\approx 4096.02$ (radius), $\theta\approx -123.623°$ (angle)

$4096.02\approx 4096=64^2$

Alternate forms:

$$\frac{1}{13\,286\,025}\left((-2\,252\,675\,999+31\,259\,520\,i)+(281\,335\,680-1\,843\,200\,i)\,e^{2/3}-\right.$$
$$(15\,206\,400+1\,055\,008\,800\,i)\,e^{4/3}-(2\,110\,017\,600-76\,032\,000\,i)\,e^2+$$
$$(256\,608\,000+2\,373\,769\,800\,i)\,e^{8/3}+(1\,424\,261\,880-615\,859\,200\,i)\,e^{10/3}-$$
$$(1\,077\,753\,600+356\,065\,470\,i)\,e^4+1\,385\,683\,200\,i\,e^{14/3}+1\,299\,078\,000\,e^{16/3}-$$
$$\left.866\,052\,000\,i\,e^6-389\,723\,400\,e^{20/3}+106\,288\,200\,i\,e^{22/3}+13\,286\,025\,e^8\right)$$

$$\left(-\frac{2\,252\,675\,999}{13\,286\,025}+\frac{8576\,i}{3645}\right)+\left(\frac{8576}{405}-\frac{8192\,i}{59\,049}\right)e^{2/3}-\left(\frac{22\,528}{19\,683}+\frac{2144\,i}{27}\right)e^{4/3}-\left(\frac{4288}{27}-\frac{112\,640\,i}{19\,683}\right)e^{2}+\left(\frac{14\,080}{729}+\frac{536\,i}{3}\right)e^{8/3}+\left(\frac{536}{5}-\frac{11\,264\,i}{243}\right)e^{10/3}-\left(\frac{19\,712}{243}+\frac{134\,i}{5}\right)e^{4}+\frac{2816}{27}\,i\,e^{14/3}+\frac{880\,e^{16/3}}{9}-\frac{1760\,i\,e^{6}}{27}-\frac{88\,e^{20/3}}{3}+8\,i\,e^{22/3}+e^{8}$$

$$-\frac{2\,252\,675\,999}{13\,286\,025}+\frac{8576\,e^{2/3}}{405}-\frac{22\,528\,e^{4/3}}{19\,683}-\frac{4288\,e^{2}}{27}+\frac{14\,080\,e^{8/3}}{729}+\frac{536\,e^{10/3}}{5}-\frac{19\,712\,e^{4}}{243}+\frac{880\,e^{16/3}}{9}-\frac{88\,e^{20/3}}{3}+e^{8}+i\left(\frac{8576}{3645}-\frac{8192\,e^{2/3}}{59\,049}-\frac{2144\,e^{4/3}}{27}+\frac{112\,640\,e^{2}}{19\,683}+\frac{536\,e^{8/3}}{3}-\frac{11\,264\,e^{10/3}}{243}-\frac{134\,e^{4}}{5}+\frac{2816\,e^{14/3}}{27}-\frac{1760\,e^{6}}{27}+8\,e^{22/3}\right)$$

Series representations:

$$\left(\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^{6}-i\,13-\frac{i\,2}{5}\right)^{2}+8+2=10+\left(-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{1}{k!}\right)^{2/3}\right)^{6}\right)^{2}$$

$$\left(\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^{6}-i\,13-\frac{i\,2}{5}\right)^{2}+8+2=10+\left(-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{(-1+k)^{2}}{k!}\right)^{2/3}\right)^{6}\right)^{2}$$

$$\left(\left(\exp\left(\frac{2}{3}\right)+\frac{i\,2}{3}\right)^{6}-i\,13-\frac{i\,2}{5}\right)^{2}+8+2=10+\left(-\frac{67\,i}{5}+\left(\frac{2\,i}{3}+\left(\sum_{k=0}^{\infty}\frac{1+2\,k}{(2\,k)!}\right)^{2/3}\right)^{6}\right)^{2}$$

We have that:

cosmological time. Keeping this in mind, the complete solutions for $\gamma < 1$ are

$$ds^2 = e^{\frac{2\alpha_0}{D-1}}\left|\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right|^{\frac{2}{(1+\gamma)(D-1)}}\left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{2}{(1-\gamma)(D-1)}} d\mathrm{x}\cdot d\mathrm{x}$$
$$-e^{-2\gamma\varphi_0}\left|\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right|^{-\frac{2\gamma}{1+\gamma}}\left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{2\gamma}{1-\gamma}}\left(\frac{d\tau}{M\beta}\right)^2, \qquad (2.13)$$
$$e^{\varphi} = e^{\varphi_0}\left[\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{1}{1+\gamma}}\left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{-\frac{1}{1-\gamma}}$$

for the *climbing* scalar, and

for all positive values of τ ($\tau = 3$) and $\gamma = 0.5$

$$\varphi = \frac{\beta\,\phi}{\sqrt{2}}\,, \qquad \beta = \sqrt{\frac{D-1}{D-2}}\,,$$

For D = 5, β = sqrt(4/3)

Input:

$$\sqrt{\frac{4}{3}}$$

Result:

$$\frac{2}{\sqrt{3}}$$

Decimal approximation:

1.154700538379251529018297561003914911295203502540253752037...

β = 1.15470053….

If consider ϕ = 0.9991104684, we obtain:

(1.15470053*0.9991104684)/sqrt2

Input interpretation:

$$\frac{1.15470053 \times 0.9991104684}{\sqrt{2}}$$

Result:

0.815770275...

0.815770275… = φ

From

$$e^{\varphi} = e^{\varphi_0}\left[\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{1}{1+\gamma}}\left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{-\frac{1}{1-\gamma}}$$

for the above data, we obtain:

exp(0.815770275) [sinh(3/2*(1-0.5^2)^0.5)]^(1/1.5) 1/[cosh(3/2*(1-0.5^2)^0.5)]^(1/0.5)

Input interpretation:

$$\exp(0.815770275)\sqrt[1.5]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\times\frac{1}{\sqrt[0.5]{\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}}$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

Result:

0.829282876163777272330967291963337791057675355492911262478...

0.8292828761637….

Alternative representations:

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}=\frac{\exp(0.81577)\sqrt[1.5]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}=\frac{\exp(0.81577)\sqrt[1.5]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{\exp(0.81577)\sqrt[1.5]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

Series representations:

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{1.5874\exp(0.81577)\left(\sum_{k=0}^{\infty} I_{1+2k}(1.29904)\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{1.29904^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

$$\frac{\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{\exp(0.81577)\left(i\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\pi}{2}\right)^{2k}}{(2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

From which:

2*(((exp(0.815770275) [sinh(3/2*(1-0.5^2)^0.5)]^(1/1.5) 1/[cosh(3/2*(1-0.5^2)^0.5)]^(1/0.5))))

Input interpretation:

$$2\left(\exp(0.815770275)\sqrt[1.5]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\times\frac{1}{\sqrt[0.5]{\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}}\right)$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

Result:

1.658565752327554544661934583926675582115350710985822524956...

1.65856575….

Alternative representations:

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}=\frac{2\exp(0.81577)\sqrt[1.5]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}=\frac{2\exp(0.81577)\sqrt[1.5]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}=\frac{2\exp(0.81577)\sqrt[1.5]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}i\sqrt{1-0.5^2}\right)}}{\sqrt[0.5]{\cos\left(-\frac{3}{2}i\sqrt{1-0.5^2}\right)}}$$

Series representations:

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{3.1748\exp(0.81577)\left(\sum_{k=0}^{\infty} I_{1+2k}(1.29904)\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{2\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{1.29904^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

$$\frac{2\exp(0.81577)\sqrt[1.5]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}}{\sqrt[0.5]{\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}} = \frac{2\exp(0.81577)\left(i\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\pi}{2}\right)^{2k}}{(2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)^2}$$

We observe that the result 1.658565... is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164.2696 i.e. 1.65578...

Indeed:

From:

$$G_{505} = P^{-1/4}Q^{1/6} = (\sqrt{5}+2)^{1/2}\left(\frac{\sqrt{5}+1}{2}\right)^{1/4}(\sqrt{101}+10)^{1/4} \times \left((130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}}\right)^{1/6}.$$

Thus, it remains to show that

$$(130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}} = \left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3,$$

which is straightforward. □

$$\sqrt[14]{\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3} = 1{,}65578\ldots$$

and:

(((((((sqrt(((113+5sqrt(505))/8)) + sqrt(((105+5sqrt(505))/8))))))^3))))^(1/14)

Input:

$$\sqrt[14]{\left(\sqrt{\frac{1}{8}\left(113+5\sqrt{505}\right)}+\sqrt{\frac{1}{8}\left(105+5\sqrt{505}\right)}\right)^3}$$

Exact result:

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14}$$

Decimal approximation:

1.655784548804744724619349561761107639558068114480697960239...

1.6557845488…

Alternate forms:

$$\sqrt[28]{338\,881+15\,080\sqrt{505}+4\sqrt{5\left(2\,871\,007\,052+127\,758\,137\sqrt{505}\right)}}$$

$$\frac{\left(5\sqrt{5}+\sqrt{101}+\sqrt{105-40\,i}+\sqrt{105+40\,i}\right)^{3/14}}{2^{3/7}}$$

$$\frac{\left(\sqrt{5\left(21+\sqrt{505}\right)}+\sqrt{113+5\sqrt{505}}\right)^{3/14}}{2^{9/28}}$$

Minimal polynomial:

$$x^{112}-1\,355\,524\,x^{84}+400\,646\,x^{56}-1\,355\,524\,x^{28}+1$$

All 14th roots of (1/2 sqrt(1/2 (105 + 5 sqrt(505))) + 1/2 sqrt(1/2 (113 + 5 sqrt(505))))^3:

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14} e^{0}\approx 1.65578$$

(real, principal root)

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14} e^{(i\pi)/7}\approx 1.4918+0.7184\,i$$

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14} e^{(2\,i\pi)/7}\approx 1.0324+1.2945\,i$$

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14} e^{(3\,i\pi)/7}\approx 0.36845+1.61427\,i$$

$$\left(\frac{1}{2}\sqrt{\frac{1}{2}\left(105+5\sqrt{505}\right)}+\frac{1}{2}\sqrt{\frac{1}{2}\left(113+5\sqrt{505}\right)}\right)^{3/14} e^{(4\,i\pi)/7}\approx -0.3684+1.61427\,i$$

Now, from

$$-e^{-2\gamma\varphi_0}\left|\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right|^{-\frac{2\gamma}{1+\gamma}}\left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{2\gamma}{1-\gamma}}\left(\frac{d\tau}{M\beta}\right)^2,$$

For: 0.815770275… = φ ; $\tau = 3$; $\gamma = 0.5$ and M = Planck mass = 2.435e+18 GeV, we obtain:

-exp(-2*0.5*0.815770275) * [sinh(3/2*(1-0.5^2)^0.5)^-((2*0.5)/(1+0.5))] * [cosh(3/2*(1-0.5^2)^0.5)^((2*0.5)/(1-0.5))] (((d*3/(1.15470053*2.435e+18))^2))

Input interpretation:

$$-\exp(-2\times0.5\times0.815770275)\sinh^{-(2\times0.5)/(1+0.5)}\left(\frac{3}{2}\sqrt{1-0.5^2}\right)\cosh^{(2\times0.5)/(1-0.5)}\left(\frac{3}{2}\sqrt{1-0.5^2}\right)\left(d\times\frac{3}{1.15470053\times2.435\times10^{18}}\right)^2$$

$\sinh(x)$ is the hyperbolic sine function

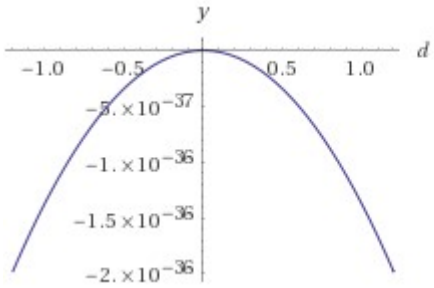
$\cosh(x)$ is the hyperbolic cosine function

Result:

$-1.37279\times10^{-36}\,d^2$

$-1.37279*10^{-36}$

Plot:



(d from −1.2 to 1.2)

Geometric figure:

line

Alternate form assuming d is real:

$0 - 1.37279\times10^{-36}\,d^2$

Root:

$d = 0$

Polynomial discriminant:

$\Delta = 0$

Property as a function:

Parity

even

Global maximum:

$$\max\left\{-1.37279\times10^{-36}\,d^2\right\} = 0 \text{ at } d = 0$$

From

$$ds^2 = e^{\frac{2a_0}{D-1}} \left|\sinh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right|^{\frac{2}{(1+\gamma)(D-1)}} \left[\cosh\left(\frac{\tau}{2}\sqrt{1-\gamma^2}\right)\right]^{\frac{2}{(1-\gamma)(D-1)}} dx\cdot dx$$

we obtain, for:

0.815770275… = φ ; $\tau = 3$; $\gamma = 0.5$; M = Planck mass = 2.435e+18 GeV

a = 4A and D = 5

e^2 [sinh(3/2(1-0.5^2)^0.5)^(1/3)] [cosh(3/2(1-0.5^2)^0.5)]

Input:

$$e^2 \sqrt[3]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

Result:

17.3546…

17.3546…

Alternative representations:

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\;3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\;3\right) =$$
$$\cos\left(\frac{3}{2}\,i\sqrt{1-0.5^2}\right)e^2\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) =$$
$$\frac{1}{2}e^2\left(e^{-3/2\sqrt{1-0.5^2}} + e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}i\sqrt{1-0.5^2}\right)}$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) =$$
$$\cos\left(-\frac{3}{2}i\sqrt{1-0.5^2}\right)e^2\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}$$

Series representations:

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) =$$
$$e^2\left(\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}\right)\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) =$$
$$\sqrt[3]{2}\ e^2\sqrt[3]{\sum_{k=0}^{\infty}I_{1+2\,k}(1.29904)}\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) =$$
$$e^2\,i\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\,\pi}{2}\right)^{1+2\,k}}{(1+2\,k)!}$$

Integral representations:

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) = 1.09112\,e^2 \sqrt[3]{\int_0^1 \cosh(1.29904\,t)\,dt}\ \int_{\frac{i\pi}{2}}^{1.29904} \sinh(t)\,dt$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) = 1.41741\,e^2 \left(0.7698 \sqrt[3]{\int_0^1 \cosh(1.29904\,t)\,dt}\ + \sqrt[3]{\int_0^1 \cosh(1.29904\,t)\,dt}\ \int_0^1 \sinh(1.29904\,t)\,dt\right)$$

$$e^2 \sqrt[3]{\sinh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right)}\cosh\left(\frac{1}{2}\sqrt{1-0.5^2}\ 3\right) = \frac{0.545562\,e^2 \left(\int_{-i\infty+\gamma}^{i\infty+\gamma} \frac{\mathcal{A}^{0.421875/s+s}}{\sqrt{s}}\,ds\right) \sqrt[3]{\int_0^1 \cosh(1.29904\,t)\,dt}\ \sqrt{\pi}}{i\pi} \quad \text{for } \gamma > 0$$

From which:

96*(((e^2 [sinh(3/2(1-0.5^2)^0.5)^(1/3)] [cosh(3/2(1-0.5^2)^0.5)])))+55+8

Input:

$$96\left(e^2 \sqrt[3]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)\right)+55+8$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

Result:

1729.04...

1729.04… This result is very near to the mass of candidate glueball $f_0(1710)$ scalar meson. Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

Alternative representations:

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\right)+55+8=63+96\cos\left(\frac{3}{2}\,i\sqrt{1-0.5^2}\right)e^2\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\right)+55+8=63+48\,e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\right)+55+8=63+48\,e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

Series representations:

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$3\left(21+32\,e^2\left(\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}\right)\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}\right)$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$3\left(21+32\sqrt[3]{2}\;e^2\sqrt[3]{\sum_{k=0}^{\infty}I_{1+2\,k}(1.29904)}\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}\right)$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$3\left(21+32\,e^2\,i\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\,\pi}{2}\right)^{1+2\,k}}{(1+2\,k)!}\right)$$

Integral representations:

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$104.748\left(0.601444+e^2\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\int_{\frac{i\,\pi}{2}}^{1.29904}\sinh(t)\,dt\right)$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$136.071\left(0.462992+0.7698\,e^2\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;+\right.$$
$$\left.e^2\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;\int_0^1\sinh(1.29904\,t)\,dt\right)$$

$$96\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+55+8=$$
$$\frac{52.3739\left(1.20289\,i\,\pi+e^2\left(\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\mathcal{A}^{0.421875/s+s}}{\sqrt{s}}\,ds\right)\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;\sqrt{\pi}\right)}{i\,\pi}$$
for $\gamma > 0$

And again, we obtain:

8*(((e^2 [sinh(3/2(1-0.5^2)^0.5)^(1/3)] [cosh(3/2(1-0.5^2)^0.5)]))+1/golden ratio

Input:

$$8\left(e^2\sqrt[3]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\,\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)\right)+\frac{1}{\phi}$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

ϕ is the golden ratio

Result:

139.455...

139.455… result practically equal to the rest mass of Pion meson 139.57 MeV

Alternative representations:

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=$$
$$\frac{1}{\phi}+8\cos\left(\frac{3}{2}i\sqrt{1-0.5^2}\right)e^2\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}$$

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=$$
$$\frac{1}{\phi}+4e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}i\sqrt{1-0.5^2}\right)}$$

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=$$
$$\frac{1}{\phi}+4e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}i\sqrt{1-0.5^2}\right)}$$

Series representations:

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=$$
$$\frac{1+8e^2\phi\left(\sum_{k=0}^{\infty}\frac{e^{0.523248k}}{(2k)!}\right)\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2k}}{(1+2k)!}}}{\phi}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=\frac{1+8\,\sqrt[3]{2}\;e^2\,\phi\,\sqrt[3]{\sum_{k=0}^{\infty}I_{1+2k}(1.29904)}\;\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2k)!}}{\phi}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=\frac{1+8\,e^2\,\phi\,i\,\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2k}}{(1+2k)!}}\;\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\,\pi}{2}\right)^{1+2k}}{(1+2k)!}}{\phi}$$

Integral representations:

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=\frac{8.72899\left(0.114561+e^2\,\phi\,\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;\int_{\frac{i\,\pi}{2}}^{1.29904}\sinh(t)\,dt\right)}{\phi}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=\frac{1}{\phi}\,11.3393\left(0.0881889+0.7698\,e^2\,\phi\,\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}+e^2\,\phi\,\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;\int_0^1\sinh(1.29904\,t)\,dt\right)$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)+\frac{1}{\phi}=\frac{4.36449\left(0.229122\,i\,\pi+e^2\,\phi\left(\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\mathcal{A}^{0.421875/s+s}}{\sqrt{s}}\,ds\right)\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\;\sqrt{\pi}\right)}{\phi\,i\,\pi}$$

for $\gamma > 0$

8*(((e^2 [sinh(3/2(1-0.5^2)^0.5)^(1/3)] [cosh(3/2(1-0.5^2)^0.5)]))-13-1/golden ratio

Input:

$$8\left(e^2\sqrt[3]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\,\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)\right)-13-\frac{1}{\phi}$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

ϕ is the golden ratio

Result:

125.218...

125.218… result very near to the Higgs boson mass 125.18 GeV

Alternative representations:

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=-13-\frac{1}{\phi}+8\cos\left(\frac{3}{2}\,i\sqrt{1-0.5^2}\right)e^2\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=$$
$$-13-\frac{1}{\phi}+4\,e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{i\cos\left(\frac{\pi}{2}+\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=$$
$$-13-\frac{1}{\phi}+4\,e^2\left(e^{-3/2\sqrt{1-0.5^2}}+e^{\left(3\sqrt{1-0.5^2}\right)/2}\right)\sqrt[3]{-i\cos\left(\frac{\pi}{2}-\frac{3}{2}\,i\sqrt{1-0.5^2}\right)}$$

Series representations:

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=$$
$$\frac{-1-13\,\phi+8\,e^2\,\phi\left(\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}\right)\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}}{\phi}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=$$
$$\frac{-1-13\,\phi+8\,\sqrt[3]{2}\;e^2\,\phi\,\sqrt[3]{\sum_{k=0}^{\infty}I_{1+2\,k}(1.29904)}\;\sum_{k=0}^{\infty}\frac{e^{0.523248\,k}}{(2\,k)!}}{\phi}$$

$$8\,e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\,\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=$$
$$\frac{-1-13\,\phi+8\,e^2\,\phi\,i\,\sqrt[3]{\sum_{k=0}^{\infty}\frac{1.29904^{1+2\,k}}{(1+2\,k)!}}\;\sum_{k=0}^{\infty}\frac{\left(1.29904-\frac{i\,\pi}{2}\right)^{1+2\,k}}{(1+2\,k)!}}{\phi}$$

Integral representations:

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=\frac{8.72899\left(-0.114561-1.48929\,\phi+e^2\,\phi\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\int_{\frac{i\pi}{2}}^{1.29904}\sinh(t)\,dt\right)}{\phi}$$

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=\frac{1}{\phi}$$
$$11.3393\left(-0.0881889-1.14646\,\phi+0.7698\,e^2\,\phi\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}+e^2\,\phi\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\int_0^1\sinh(1.29904\,t)\,dt\right)$$

$$8e^2\left(\sqrt[3]{\sinh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)}\cosh\left(\frac{3\sqrt{1-0.5^2}}{2}\right)\right)-13-\frac{1}{\phi}=\frac{1}{\phi i\pi}4.36449\left(-0.229122\,i\pi-2.97858\,\phi i\pi+e^2\,\phi\left(\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{\mathcal{A}^{0.421875/s+s}}{\sqrt{s}}\,ds\right)\sqrt[3]{\int_0^1\cosh(1.29904\,t)\,dt}\sqrt{\pi}\right)\quad\text{for }\gamma>0$$

(((e^2 [sinh(3/2(1-0.5^2)^0.5)^(1/3)] [cosh(3/2(1-0.5^2)^0.5)])))^(1/6)

Input:

$$\sqrt[6]{e^2\sqrt[3]{\sinh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}\cosh\left(\frac{3}{2}\sqrt{1-0.5^2}\right)}$$

$\sinh(x)$ is the hyperbolic sine function

$\cosh(x)$ is the hyperbolic cosine function

Result:

1.609048...

1.609048…

From the three above results

17.3546; -1.37279*10^{-36} ; 0.8292828761637;

we obtain:

(17.3546 -1.37279*10^-36 + 0.8292828761637)*1/11

Input interpretation:

$$\left(17.3546 - 1.37279 \times 10^{-36} + 0.8292828761637\right) \times \frac{1}{11}$$

Result:

1.653080261469427272727272727272727272602473636363636363636...

Repeating decimal:

1.653080261469427272727272727272727272602473$\overline{6}$

(period 2)

1.6530802614…. result very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164.2696 i.e. 1.65578...

log base 2 (3) (17.3546 -1.37279*10^-36 + 0.8292828761637)

Input interpretation:

$$\log_2(3)\left(17.3546 - 1.37279 \times 10^{-36} + 0.8292828761637\right)$$

$\log_b(x)$ is the base-b logarithm

Result:

28.8208...

28.8208…

From (2.15)

$$e^{\varphi} = e^{\varphi_0} \left[\sin\left(\frac{\tau}{2}\sqrt{\gamma^2-1}\right)\right]^{\frac{1}{1+\gamma}} \left[\cos\left(\frac{\tau}{2}\sqrt{\gamma^2-1}\right)\right]^{\frac{1}{\gamma-1}}$$

we obtain:

exp(0.815770275) [sin(3/2*(0.5^2-1)^0.5)]^(1/1.5) [cos(3/2*(0.5^2-1)^0.5)]^(1/(-0.5))

Input interpretation:

$$\exp(0.815770275)\sqrt[1.5]{\sin\left(\frac{3}{2}\sqrt{0.5^2-1}\right)}\cos^{-1/0.5}\left(\frac{3}{2}\sqrt{0.5^2-1}\right)$$

Result:

0.414641... +
0.718180... i

Polar coordinates:

$r = 0.829283$ (radius), $\theta = 60°$ (angle)

0.829283……as the previous result

Alternative representations:

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right) =$$
$$\exp(0.81577)\cosh^{-1/0.5}\left(\frac{3}{2}i\sqrt{-1+0.5^2}\right)\sqrt[1.5]{\cos\left(\frac{\pi}{2}-\frac{3}{2}\sqrt{-1+0.5^2}\right)}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right) =$$
$$\exp(0.81577)\cosh^{-1/0.5}\left(-\frac{3}{2}i\sqrt{-1+0.5^2}\right)\sqrt[1.5]{\cos\left(\frac{\pi}{2}-\frac{3}{2}\sqrt{-1+0.5^2}\right)}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=$$
$$\exp(0.81577)\cosh^{-1/0.5}\left(-\frac{3}{2}\,i\sqrt{-1+0.5^2}\ \right)\sqrt[1.5]{-\cos\left(\frac{\pi}{2}+\frac{3}{2}\sqrt{-1+0.5^2}\ \right)}$$

Series representations:

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=$$
$$\frac{1.5874\exp(0.81577)\left(\sum_{k=0}^{\infty}(-1)^k J_{1+2k}(1.29904\,i)\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{(-1)^k e^{(0.523248+3.14159\,i)k}}{(2k)!}\right)^2}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=$$
$$\frac{\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{(-1)^k(1.29904\,i)^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{(-1)^k e^{(0.523248+3.14159\,i)k}}{(2k)!}\right)^2}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=$$
$$\frac{1.5874\exp(0.81577)\left(\sum_{k=0}^{\infty}(-1)^k J_{1+2k}(1.29904\,i)\right)^{0.666667}}{\left(J_0(1.29904\,i)+2\sum_{k=1}^{\infty}(-1)^k J_{2k}(1.29904\,i)\right)^2}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=$$
$$\frac{\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{(-1)^k(1.29904\,i)^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(J_0(1.29904\,i)+2\sum_{k=1}^{\infty}(-1)^k J_{2k}(1.29904\,i)\right)^2}$$

Multiple-argument formulas:

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=\frac{\exp(0.81577)\sin^{0.666667}(1.29904\,i)}{(-1+2\cos^2(0.649519\,i))^2}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=\frac{1.5874\exp(0.81577)(\cos(0.649519\,i)\sin(0.649519\,i))^{0.666667}}{(-1+2\cos^2(0.649519\,i))^2}$$

$$\exp(0.81577)\sqrt[1.5]{\sin\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)}\cos^{-1/0.5}\left(\frac{1}{2}\sqrt{0.5^2-1}\ 3\right)=\frac{1.5874\exp(0.81577)(\cos(0.649519\,i)\sin(0.649519\,i))^{0.666667}}{(1-2\sin^2(0.649519\,i))^2}$$

And also:

2*(((exp(0.815770275) [sin(3/2*(0.5^2-1)^0.5)]^(1/1.5) [cos(3/2*(0.5^2-1)^0.5)]^(1/(-0.5)))))

Input interpretation:

$$2\left(\exp(0.815770275)\sqrt[1.5]{\sin\left(\frac{3}{2}\sqrt{0.5^2-1}\right)}\cos^{-1/0.5}\left(\frac{3}{2}\sqrt{0.5^2-1}\right)\right)$$

Result:

0.829283... +
1.43636... i

Polar coordinates:

$r = 1.65857$ (radius), $\theta = 60°$ (angle)

1.65857 result very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164.2696 i.e. 1.65578...

Alternative representations:

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=$$
$$2\exp(0.81577)\cosh^{-1/0.5}\left(\frac{3}{2}i\sqrt{-1+0.5^2}\right)\sqrt[1.5]{\cos\left(\frac{\pi}{2}-\frac{3}{2}\sqrt{-1+0.5^2}\right)}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=$$
$$2\exp(0.81577)\cosh^{-1/0.5}\left(-\frac{3}{2}i\sqrt{-1+0.5^2}\right)\sqrt[1.5]{\cos\left(\frac{\pi}{2}-\frac{3}{2}\sqrt{-1+0.5^2}\right)}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=$$
$$2\exp(0.81577)\cosh^{-1/0.5}\left(-\frac{3}{2}i\sqrt{-1+0.5^2}\right)\sqrt[1.5]{-\cos\left(\frac{\pi}{2}+\frac{3}{2}\sqrt{-1+0.5^2}\right)}$$

Series representations:

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=$$
$$\frac{3.1748\exp(0.81577)\left(\sum_{k=0}^{\infty}(-1)^k J_{1+2k}(1.29904\,i)\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{(-1)^k e^{(0.523248+3.14159\,i)k}}{(2k)!}\right)^2}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{2\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{(-1)^k(1.29904\,i)^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(\sum_{k=0}^{\infty}\frac{(-1)^k e^{(0.523248+3.14159\,i)k}}{(2k)!}\right)^2}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{3.1748\exp(0.81577)\left(\sum_{k=0}^{\infty}(-1)^k J_{1+2k}(1.29904\,i)\right)^{0.666667}}{\left(J_0(1.29904\,i)+2\sum_{k=1}^{\infty}(-1)^k J_{2k}(1.29904\,i)\right)^2}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{2\exp(0.81577)\left(\sum_{k=0}^{\infty}\frac{(-1)^k(1.29904\,i)^{1+2k}}{(1+2k)!}\right)^{0.666667}}{\left(J_0(1.29904\,i)+2\sum_{k=1}^{\infty}(-1)^k J_{2k}(1.29904\,i)\right)^2}$$

Multiple-argument formulas:

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{2\exp(0.81577)\sin^{0.666667}(1.29904\,i)}{\left(-1+2\cos^2(0.649519\,i)\right)^2}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{3.1748\exp(0.81577)\,(\cos(0.649519\,i)\sin(0.649519\,i))^{0.666667}}{(-1+2\cos^2(0.649519\,i))^2}$$

$$2\exp(0.81577)\left(\sqrt[1.5]{\sin\left(\frac{3\sqrt{0.5^2-1}}{2}\right)}\cos^{-1/0.5}\left(\frac{3\sqrt{0.5^2-1}}{2}\right)\right)=\frac{3.1748\exp(0.81577)\,(\cos(0.649519\,i)\sin(0.649519\,i))^{0.666667}}{(1-2\sin^2(0.649519\,i))^2}$$

Observations

From:
https://www.scientificamerican.com/article/mathematics-ramanujan/?fbclid=IwAR2caRXrn_RpOSvJ1QxWsVLBcJ6KVgd_Af_hrmDYBNyU8mpSjRs1BDeremA

Ramanujan's statement concerned the deceptively simple concept of partitions—the different ways in which a whole number can be subdivided into smaller numbers. Ramanujan's original statement, in fact, stemmed from the observation of patterns, such as the fact that p(9) = 30, p(9 + 5) = 135, p(9 + 10) = 490, p(9 + 15) = 1,575 and so on are all divisible by 5. Note that here the n's come at intervals of five units.

Ramanujan posited that this pattern should go on forever, and that similar patterns exist when 5 is replaced by 7 or 11—there are infinite sequences of p(n) that are all divisible by 7 or 11, or, as mathematicians say, in which the "moduli" are 7 or 11.

Then, in nearly oracular tone Ramanujan went on: "There appear to be corresponding properties," he wrote in his 1919 paper, "in which the moduli are powers of 5, 7 or 11...and no simple properties for any moduli involving primes other than these three." (Primes are whole numbers that are only divisible by themselves or by 1.) Thus, for instance, there should be formulas for an infinity of n's separated by 5^3 = 125 units, saying that the corresponding p(n)'s should all be divisible by 125.
In the past methods developed to understand partitions have later been applied to physics problems such as the theory of the strong nuclear force or the entropy of black holes.

From Wikipedia

In particle physics, Yukawa's interaction or Yukawa coupling, named after Hideki Yukawa, is an interaction between a scalar field ϕ and a Dirac field ψ. The Yukawa interaction can be used to describe the nuclear force between nucleons (which are fermions), mediated by pions (which are pseudoscalar mesons). The Yukawa interaction is also used in the Standard Model to describe the coupling between the Higgs field and massless quark and lepton fields (i.e., the fundamental fermion particles). Through spontaneous symmetry breaking, these fermions acquire a mass proportional to the vacuum expectation value of the Higgs field.

Can be this the motivation that from the development of the Ramanujan's equations we obtain results very near to the dilaton mass calculated as a type of Higgs boson:

125 GeV for T = 0 and to the Higgs boson mass 125.18 GeV and practically equal to the rest mass of Pion meson 139.57 MeV

Note that:

$$g_{22} = \sqrt{(1+\sqrt{2})}.$$

Hence

$$\begin{aligned} 64g_{22}^{24} &= e^{\pi\sqrt{22}} - 24 + 276e^{-\pi\sqrt{22}} - \cdots, \\ 64g_{22}^{-24} &= 4096e^{-\pi\sqrt{22}} + \cdots, \end{aligned}$$

so that

$$64(g_{22}^{24} + g_{22}^{-24}) = e^{\pi\sqrt{22}} - 24 + 4372e^{-\pi\sqrt{22}} + \cdots = 64\{(1+\sqrt{2})^{12} + (1-\sqrt{2})^{12}\}.$$

Hence

$$e^{\pi\sqrt{22}} = 2508951.9982\ldots.$$

Thence:

$$64g_{22}^{-24} = 4096e^{-\pi\sqrt{22}} + \cdots$$

And

$$64(g_{22}^{24} + g_{22}^{-24}) = e^{\pi\sqrt{22}} - 24 + 4372e^{-\pi\sqrt{22}} + \cdots = 64\{(1+\sqrt{2})^{12} + (1-\sqrt{2})^{12}\}$$

That are connected with 64, 128, 256, 512, 1024 and 4096 = 64^2

(Modular equations and approximations to π - S. Ramanujan - Quarterly Journal of Mathematics, XLV, 1914, 350 – 372)

All the results of the most important connections are signed in blue throughout the drafting of the paper. We highlight as in the development of the various equations we use always the constants π, ϕ, 1/ϕ, the Fibonacci and Lucas numbers, linked to the golden ratio, that play a fundamental role in the development, and therefore, in the final results of the analyzed expressions.

In mathematics, the Fibonacci numbers, commonly denoted F_n, form a sequence, called the Fibonacci sequence, such that each number is the sum of the two preceding ones, starting from 0 and 1. Fibonacci numbers are strongly related to the golden ratio: Binet's formula expresses the nth Fibonacci number in terms of n and the golden ratio, and implies that the ratio of two consecutive Fibonacci numbers tends to the golden ratio as n increases.
Fibonacci numbers are also closely related to Lucas numbers ,in that the Fibonacci and Lucas numbers form a complementary pair of Lucas sequences

The beginning of the sequence is thus:

0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, 610, 987, 1597, 2584, 4181, 6765, 10946, 17711, 28657, 46368, 75025, 121393, 196418, 317811, 514229, 832040, 1346269, 2178309, 3524578, 5702887, 9227465, 14930352, 24157817, 39088169, 63245986, 102334155...

The Lucas numbers or Lucas series are an integer sequence named after the mathematician François Édouard Anatole Lucas (1842–91), who studied both that sequence and the closely related Fibonacci numbers. Lucas numbers and Fibonacci numbers form complementary instances of Lucas sequences.

The Lucas sequence has the same recursive relationship as the Fibonacci sequence, where each term is the sum of the two previous terms, but with different starting values. This produces a sequence where the ratios of successive terms approach the golden ratio, and in fact the terms themselves are roundings of integer powers of the golden ratio.[1] The sequence also has a variety of relationships with the Fibonacci numbers, like the fact that adding any two Fibonacci numbers two terms apart in the Fibonacci sequence results in the Lucas number in between.

The sequence of Lucas numbers is:

2, 1, 3, 4, 7, 11, 18, 29, 47, 76, 123, 199, 322, 521, 843, 1364, 2207, 3571, 5778, 9349, 15127, 24476, 39603, 64079, 103682, 167761, 271443, 439204, 710647, 1149851, 1860498, 3010349, 4870847, 7881196, 12752043, 20633239, 33385282, 54018521, 87403803……

All Fibonacci-like integer sequences appear in shifted form as a row of the Wythoff array; the Fibonacci sequence itself is the first row and the Lucas sequence is the second row. Also like all Fibonacci-like integer sequences, the ratio between two consecutive Lucas numbers converges to the golden ratio.

A Lucas prime is a Lucas number that is prime. The first few Lucas primes are:

2, 3, 7, 11, 29, 47, 199, 521, 2207, 3571, 9349, 3010349, 54018521, 370248451, 6643838879, ... (sequence A005479 in the OEIS).

In geometry, a golden spiral is a logarithmic spiral whose growth factor is φ, the golden ratio.[1] That is, a golden spiral gets wider (or further from its origin) by a factor of φ for every quarter turn it makes. Approximate logarithmic spirals can occur in nature, for example the arms of spiral galaxies[3] - golden spirals are one special case of these logarithmic spirals

We observe that 1728 and 1729 are results very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. As a consequence, it is sometimes called a Zagier as a pun on the Gross–Zagier theorem. The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number).

Furthermore, we obtain as results of our computations, always values very near to the Higgs boson mass 125.18 GeV and practically equals to the rest mass of Pion meson 139.57 MeV. In conclusion we obtain also many results that are very good approximations to the value of the golden ratio 1.618033988749... and to ζ(2) = $\frac{\pi^2}{6} = 1.644934 \ldots$

We note how the following three values: 137.508 (golden angle), 139.57 (mass of the Pion - meson Pi) and 125.18 (mass of the Higgs boson), are connected to each other. In fact, just add 2 to 137.508 to obtain a result very close to the mass of the Pion and subtract 12 to 137.508 to obtain a result that is also very close to the mass of the Higgs boson. We can therefore hypothesize that it is the golden angle (and the related golden ratio inherent in it) to be a fundamental ingredient both in the structures of the microcosm and in those of the macrocosm.

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