On the possible relationships between several Ramanujan formulas, some equations concerning the Higher Spins Fields in String Theory and some sectors of Number Theory.

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Abstract

In this paper, we describe and analyze the possible relationships between several Ramanujan formulas, some equations concerning the Higher Spins Fields in String Theory and some sectors of Number Theory.

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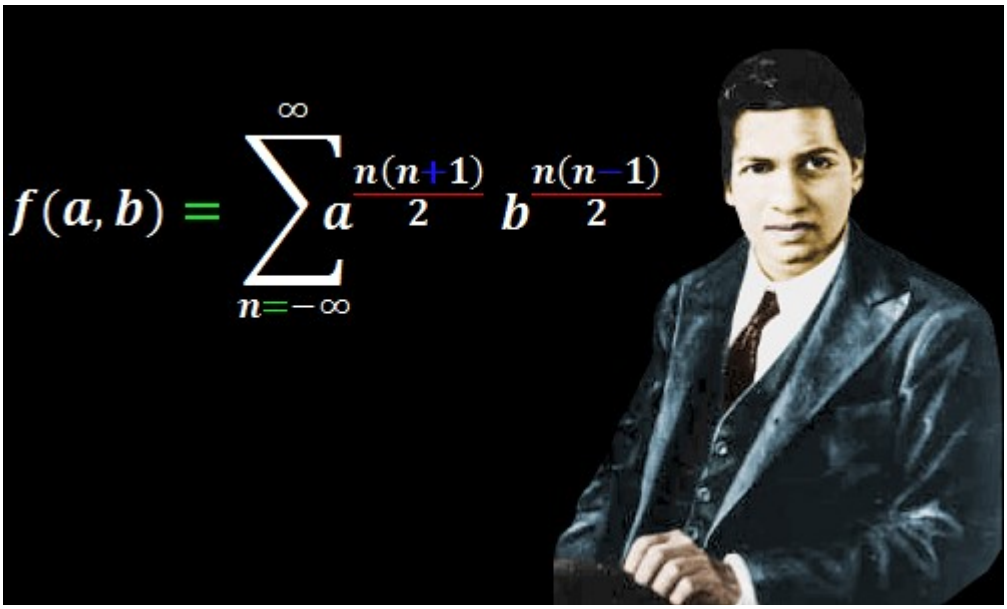


https://sevalaya.org/events/srinivasa-ramanujan-day-celebrations/

From:

Notes on Strings and Higher Spins - *A. Sagnotti* – arXiv:1112.4285v4 [hep-th] 21 Jun 2012

This phenomenon has a very instructive counterpart in the presence of a cosmological constant λ that deforms Minkowski space to (A)dS backgrounds depending on its (negative)positive sign. Starting from the deformed equations of Section 3.1 and focussing on the dS case, for $s = 2$ the resulting massive exchange for a generic mass M, computed some time ago in [54], reads[2]

$$\mathcal{E}_\lambda(D,2) \;=\; T^{\mu\nu}\,T_{\mu\nu} \;-\; \frac{1}{D-1}\,\frac{(ML)^2-(D-1)}{(ML)^2-(D-2)}\;(T^\mu{}_\mu)^2 \;, \tag{3.23}$$

where the relation between L and the cosmological constant is given in eq. (3.4). Notice that this exchange is a rational function of ML with a simple pole determined by the condition

$$(ML)^2 = D-2\;. \tag{3.24}$$

More details can be found in [10], where eq. (3.23) was extended to symmetric tensors of arbitrary rank. The first terms, drawn from [10] but adapted to the index–free notation of Section 2.1, read

$$\begin{aligned}
\mathcal{E}_\lambda(D,s) &= \mathcal{J}_s \;+\; \frac{g\,\mathcal{J}_s'}{2(\frac{5}{2}-\zeta)}\,\frac{(ML)^2+2(\frac{5}{2}-\zeta)}{(ML)^2-2(\zeta-3)} \\
&+\frac{g^2\,\mathcal{J}_s^{[2]}}{8}\,\frac{(ML)^4+8(ML)^2(\frac{7}{2}-\zeta)+12\,(\frac{5}{2}-\zeta)_2}{(\frac{5}{2}-\zeta)_2\,[(ML)^2-2(\zeta-3)][(ML)^2-6(\zeta-4)]} \\
&+\frac{g^3\,\mathcal{J}_s^{[3]}}{48}\,\frac{(ML)^6+(ML)^4(18\zeta-77)+92(ML)^2\,(\frac{7}{2}-\zeta)_2+120\,(\frac{5}{2}-\zeta)_3}{(\frac{5}{2}-\zeta)_3\,[(ML)^2-2(\zeta-3)][(ML)^2-6(\zeta-4)][(ML)^2-10(\zeta-5)]} \\
&+\ldots\,,
\end{aligned} \tag{3.27}$$

where $\mathcal{J}_s^{[2,3]}$ are higher traces of $\mathcal{J}_s$, g is the background dS metric, $\zeta = \frac{D}{2}+s$ and

$$(a)_n = a(a+1)\ldots(a+n-1) \tag{3.28}$$

are Pochhammer symbols.

For all $s \geq 2$ a first pole thus appears at $r = s-2$, and for $s > 3$ others lie at alternate values of r below it. For instance, for $s = 3$ the relevant value is $r = 1$, since for $r = 0$ all terms present in the partially massless gauge transformation contain gradients of the parameter and are thus manifestly compatible with conserved currents.

From:

(A)dS exchanges and partially-massless higher spins
D. Francia, J. Mourad and A. Sagnotti - arXiv:0803.3832v2 [hep-th] 30 Apr 2008

$$
\begin{aligned}
\mathcal{K}(x,u^a) &= J_s + \frac{u^2}{4(\frac{5}{2}-\zeta)}\frac{(ML)^2+2(\frac{5}{2}-\zeta)}{(ML)^2-2(\zeta-3)}\,J_s' \\
&+ \frac{(u^2)^2}{32}\frac{(ML)^4+8(ML)^2(\frac{7}{2}-\zeta)+12\,(\frac{5}{2}-\zeta)_2}{(\frac{5}{2}-\zeta)_2\,[(ML)^2-2(\zeta-3)][(ML)^2-6(\zeta-4)]}\,J_s^{[2]} \\
&+ \frac{(u^2)^3}{384}\frac{(ML)^6-(ML)^4(18\zeta-77)+92(ML)^2\,(\frac{7}{2}-\zeta)_2+120\,(\frac{5}{2}-\zeta)_3}{(\frac{5}{2}-\zeta)_3\,[(ML)^2-2(\zeta-3)][(ML)^2-6(\zeta-4)][(ML)^2-10(\zeta-5)]}\,J_s^{[3]} \\
&+ \cdots + (u^2)^n\,\frac{\mathcal{N}_n}{\mathcal{D}_n}\,J_s^{[n]} + \ldots\,, \qquad (7.50)
\end{aligned}
$$

For $u^2 = 2$ and $J_S = 1$, $s = 3$ $\zeta = D/2 + s = 10/2 + 3 = 8$ for $D = 10$

[1+((8+2*(5/2-8)))/(((2(5/2-8) 8-2(8 - 3))))+1/8((64+64*(7/2-8)+12(5/2-8)))/((5/2-8)(8-2*5)(8-6*4))+1/48*(((512)-64(18*8-67)+92*8*(7/2-8)+120(5/2-8)))/(((5/2-8)(8-2*5)(8-6*4)(8-10*3)))]

Input:

$$
1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)\times 8-2\,(8-3)}+\frac{1}{8}\times\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)}+
$$
$$
\frac{1}{48}\times\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\,(8-10\times 3)}
$$

Exact result:

$$\frac{904\,203}{758\,912}$$

Decimal approximation:

1.191446439112835216731320627424523528419632315736211840107...

1.191446439…

[1+((8+2*(5/2-8)))/(((2(5/2-8) * 8-2(8 - 3))))+1/8*((64+64*(7/2-8)+12(5/2-8))) / ((5/2-8)(8-2*5)(8-6*4))+1/48*(((512)-64(18*8-67)+92*8*(7/2-8)+120(5/2-8)))/(((5/2-8)(8-2*5)(8-6*4)(8-10*3)))]^e

Input:

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)\times 8-2\,(8-3)}+\frac{1}{8}\times\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)}+\frac{1}{48}\times\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\,(8-10\times 3)}\right)^e$$

Exact result:

$$\left(\frac{904\,203}{758\,912}\right)^e$$

Decimal approximation:

1.609874403107491815515282146867855015793911817400515888837...

1.6098744031…. result that is a good approximation to the value of the golden ratio 1.618033988749...

Alternative representation:

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\,(8-3)}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\right)8}+\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\,(8-10\times 3)\right)48}\right)^e=$$

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\,(8-3)}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\right)8}+\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times 5)\,(8-6\times 4)\,(8-10\times 3)\right)48}\right)^{\exp(z)}\quad \text{for } z=1$$

Series representations:

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2(8-3)}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)\right)8}+\frac{512-64(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)(8-10\times3)\right)48}\right)^{e}=\left(\frac{904\,203}{758\,912}\right)^{\sum_{k=0}^{\infty}1/k!}$$

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2(8-3)}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)\right)8}+\frac{512-64(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)(8-10\times3)\right)48}\right)^{e}=\left(\frac{904\,203}{758\,912}\right)^{\sum_{k=0}^{\infty}(-1+k)^2/k!}$$

$$\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2(8-3)}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)\right)8}+\frac{512-64(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(8-2\times5)(8-6\times4)(8-10\times3)\right)48}\right)^{e}=\left(\frac{904\,203}{758\,912}\right)^{\left(\sum_{k=0}^{\infty}\frac{-1+k+z}{k!}\right)/z}$$

Integral representation:

$$(1+z)^a=\frac{\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{\Gamma(s)\Gamma(-a-s)}{z^s}\,ds}{(2\pi i)\,\Gamma(-a)}\quad\text{for } (0<\gamma<-\mathrm{Re}(a) \text{ and } |\arg(z)|<\pi)$$

10^3[1+((8+2*(5/2-8)))/(((2(5/2-8) 8-2*5)))+1/8((64+64*(7/2-8)+12(5/2-8)))/((5/2-8)(8-10)(8-6*4))+1/48*(((512)-64(18*8-67)+92*8*(7/2-8)+120(5/2-8)))/(((5/2-8)(8-2*5)(8-6*4)(8-10*3)))]

Input:

$$10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)\times 8-2\times 5}+\frac{1}{8}\times\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-10)(8-6\times 4)}+\frac{1}{48}\times\frac{512-64(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)(8-6\times 4)(8-10\times 3)}\right)$$

Exact result:

$$\frac{113\,025\,375}{94\,864}$$

Decimal approximation:

1191.446439112835216731320627424523528419632315736211840107...

1191.44643911…. result very near to the rest mass of Sigma baryon 1192.642

Furthermore, we have that:

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

We have that:

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

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. □

From the right-hand side of the last expression, we obtain:

$$\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3 = 1164.2248$$

and performing the 14th root:

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

We observe that

$\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3 + 27 = 1191.2248$ a value practically equal to the result of the above expression.

With regard 27 (From Wikipedia), we remember that:

*"The fundamental group of the complex form, compact real form, or any algebraic version of E_6 is the cyclic group **Z**/3**Z**, and its outer automorphism group is the cyclic group **Z**/2**Z**. Its fundamental representation is 27-dimensional (complex), and a basis is given by the 27 lines on a cubic surface. The dual representation, which is inequivalent, is also 27-dimensional. In particle physics, E_6 plays a role in some grand unified theories".*

We have also:

144+11^3[1+((8+2*(5/2-8)))/(((2(5/2-8) 8-2*5)))+1/8((64+64*(7/2-8)+12(5/2-8)))/((5/2-8)(8-10)(8-6*4))+1/48*(((512)-64(18*8-67)+92*8*(7/2-8)+120(5/2-8)))/(((5/2-8)(8-2*5)(8-6*4)(8-10*3)))]-1

Input:

$$144+11^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)\times 8-2\times 5}+\frac{1}{8}\times\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-10)(8-6\times 4)}+\frac{1}{48}\times\frac{512-64(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)(8-2\times 5)(8-6\times 4)(8-10\times 3)}\right)-1$$

Exact result:

$$\frac{10\,843\,129}{6272}$$

Decimal approximation:

1728.81521045918367346938775510204081632653061224489795918 3...

1728.81521….

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)

8*((10^3[1+((8+2*(5/2-8)))/(((2(5/2-8) 8-2*5)))+1/8((64+64(7/2-8)+12(5/2-8)))/((5/2-8)(-2)(-16))+1/48(((512)-64(18*8-67)+92*8(7/2-8)+120(5/2-8)))/(((5/2-8)(-2)(-16)(-22)))]-(144+21+2)))-Pi

Input:

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)\times 8-2\times 5}+\frac{1}{8}\times\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)\times(-2)\times(-16)}+\frac{1}{48}\times\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\frac{5}{2}-8\right)\times(-2)\times(-16)\times(-22)}\right)-(144+21+2)\right)-\pi$$

Result:

$$\frac{97\,183\,087}{11\,858}-\pi$$

Decimal approximation:

8192.429920249091940612102376012908724472861356490319615042...

8192.4299202… ≈ 8192 = $2*64^2$

Property:

$\frac{97\,183\,087}{11\,858}-\pi$ is a transcendental number

Alternate form:

$$\frac{97\,183\,087-11\,858\,\pi}{11\,858}$$

Alternative representations:

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times 5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\frac{512-64\,(18\times 8-67)+92\times 8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-(144+21+2)\right)-$$

$$\pi=-180^\circ+8\left(-167+10^3\left(1--\frac{3}{98}--\frac{290}{176\times 8}-\frac{8388}{48\times 3872}\right)\right)$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-(144+21+2)\right)-$$
$$\pi=i\log(-1)+8\left(-167+10^3\left(1--\frac{3}{98}--\frac{290}{176\times8}-\frac{8388}{48\times3872}\right)\right)$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-(144+21+2)\right)-$$
$$\pi=-\cos^{-1}(-1)+8\left(-167+10^3\left(1--\frac{3}{98}--\frac{290}{176\times8}-\frac{8388}{48\times3872}\right)\right)$$

Series representations:

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-\right.$$
$$\left.(144+21+2)\right)-\pi=\frac{97\,183\,087}{11\,858}-4\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2k}$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-(144+21+2)\right)-$$
$$\pi=\frac{97\,183\,087}{11\,858}+\sum_{k=0}^{\infty}\frac{4\,(-1)^k\,1195^{-1-2k}\left(5^{1+2k}-4\times239^{1+2k}\right)}{1+2k}$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-(144+21+2)\right)-$$
$$\pi=\frac{97\,183\,087}{11\,858}-\sum_{k=0}^{\infty}\left(-\frac{1}{4}\right)^k\left(\frac{1}{1+2k}+\frac{2}{1+4k}+\frac{1}{3+4k}\right)$$

Integral representations:

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-$$
$$(144+21+2)\Bigg)-\pi=\frac{97\,183\,087}{11\,858}-4\int_0^1\sqrt{1-t^2}\,dt$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-$$
$$(144+21+2)\Bigg)-\pi=\frac{97\,183\,087}{11\,858}-2\int_0^1\frac{1}{\sqrt{1-t^2}}\,dt$$

$$8\left(10^3\left(1+\frac{8+2\left(\frac{5}{2}-8\right)}{2\left(\frac{5}{2}-8\right)8-2\times5}+\frac{64+64\left(\frac{7}{2}-8\right)+12\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)\right)8}+\right.\right.$$
$$\left.\left.\frac{512-64\,(18\times8-67)+92\times8\left(\frac{7}{2}-8\right)+120\left(\frac{5}{2}-8\right)}{\left(\left(\frac{5}{2}-8\right)(-2)(-16)(-22)\right)48}\right)-$$
$$(144+21+2)\Bigg)-\pi=\frac{97\,183\,087}{11\,858}-2\int_0^\infty\frac{1}{1+t^2}\,dt$$

From:

$$(ML)^2 = (s-1)(d-4+s).$$

For s = 2 and d = 10 , $(ML)^2 = 8$

s = 3 and d = 10 , $(ML)^2 = (3-1)(10-4+3) = 2*9 = 18$

s = 4 and d = 10 , $(ML)^2 = (4-1)(10-4+4) = 3*10 = 30$

s = 5 and d = 10 , $(ML)^2 = (5-1)(10-4+5) = 4*11 = 44$

s = 6 and d = 10 , $(ML)^2 = (6-1)(10-4+6) = 5*12 = 60$

s = 7 and d = 10 , $(ML)^2 = (7-1)(10-4+7) = 6*13 = 78$

from:

$$\mathbf{s=2:}\quad (J_{ab})^2 - \frac{1}{d-1}\frac{(ML)^2-(d-1)}{(ML)^2-(d-2)}\,(J')^2 \tag{7.53}$$

$$\mathbf{s=3:}\quad (J_{abc})^2 - \frac{3}{d+1}\frac{(ML)^2-(d+1)}{(ML)^2-d}\,(J'_a)^2 \tag{7.54}$$

$$\mathbf{s=4:}\quad (J_{abcd})^2 - \frac{6}{d+3}\frac{(ML)^2-(d+3)}{(ML)^2-(d+2)}\,(J'_{ab})^2 + \frac{3}{(d+1)(d+3)}\frac{(ML)^4-4(ML)^2(d+1)+3(d+1)(d+3)}{[(ML)^2-(d+2)][(ML)^2-3d]}\,(J'')^2$$

$$\mathbf{s=5:}\quad (J_{abcde})^2 - \frac{10}{d+5}\frac{(ML)^2-(d+5)}{(ML)^2-(d+4)}\,(J'_{abc})^2 + \frac{15}{(d+3)(d+5)}\frac{(ML)^4-4(ML)^2(d+3)+3(d+3)(d+5)}{[(ML)^2-(d+4)][(ML)^2-3(d+2)]}\,(J''_a)^2 \tag{7.55}$$

$$\mathbf{s=6:}\quad (J_{abcdef})^2 - \frac{15}{d+7}\frac{(ML)^2-(d+7)}{(ML)^2-(d+6)}\left(J'^{abcd}\right)^2 + \frac{45}{(d+5)(d+7)}\frac{(ML)^4-4(ML)^2(d+5)+3(d+5)(d+7)}{[(ML)^2-(d+6)][(ML)^2-3(d+4)]}\,(J''_{ab})^2 - \frac{15[(ML)^6-(ML)^4(9d+31)+23(ML)^2(d+3)(d+5)-15(d+3)(d+5)(d+7)]}{(d+3)(d+5)(d+7)[(ML)^2-(d+6)][(ML)^2-3(d+4)][(ML)^2-5(d+2)]}\,(J''')^2 \tag{7.56}$$

$$\mathbf{s=7:}\quad (J_{abcdefg})^2 - \frac{21}{d+9}\frac{(ML)^2-(d+9)}{(ML)^2-(d+8)}\left(J'^{abcde}\right)^2 + \frac{105}{(d+7)(d+9)}\frac{(ML)^4-4(ML)^2(d+7)+3(d+7)(d+9)}{[(ML)^2-(d+8)][(ML)^2-3(d+6)]}\,(J''_{abc})^2 - \frac{105[(ML)^6-(ML)^4(9d+49)+23(ML)^2(d+5)(d+7)-15(d+5)(d+7)(d+9)]}{(d+5)(d+7)(d+9)[(ML)^2-(d+8)][(ML)^2-3(d+6)][(ML)^2-5(d+4)]}\,(J'''_a)^2 \tag{7.57}$$

For:

$s = 2$ and $d = 10$, $(ML)^2 = 8$

$s = 3$ and $d = 10$, $(ML)^2 = 18$

$s = 4$ and $d = 10$, $(ML)^2 = 30$

$s = 5$ and $d = 10$, $(ML)^2 = 44$

$s = 6$ and $d = 10$, $(ML)^2 = 60$

$s = 7$ and $d = 10$, $(ML)^2 = 78$

we obtain:

$$\mathbf{s = 1:} \quad (J_a)^2 = 1$$

$$\mathbf{s = 2:} \quad (J_{ab})^2 - \frac{1}{d-1}\,\frac{(ML)^2-(d-1)}{(ML)^2-(d-2)}\,(J')^2$$

Input:

$$1 - \frac{1}{9} \times \frac{8-9}{8-8}$$

Result:

$\tilde{\infty}$

$$\mathbf{s = 3:} \quad (J_{abc})^2 - \frac{3}{d+1}\,\frac{(ML)^2-(d+1)}{(ML)^2-d}\,(J'_a)^2$$

Input:

$$1 - \frac{3}{11} \times \frac{18-11}{18-10}$$

Exact result:

$$\frac{67}{88}$$

Decimal approximation:

0.761363636363636363636363636363636363636363636363636363636363636...

0.7613636…

$$\mathbf{s=4:}\qquad (J_{abcd})^2 \;-\; \frac{6}{d+3}\,\frac{(ML)^2-(d+3)}{(ML)^2-(d+2)}\;(J'_{ab})^2 + \frac{3}{(d+1)(d+3)}\,\frac{(ML)^4-4(ML)^2(d+1)+3(d+1)(d+3)}{[(ML)^2-(d+2)][(ML)^2-3d]}\;(J'')^2$$

Input:

$$1-\frac{6}{13}\times\frac{30-13}{30-12}+\frac{3}{11\times13}\times\frac{30^2-4\times30\times11+3\,(11\times13)}{(30-12)\,(30-30)}$$

Result:

$\tilde{\infty}$

$$\mathbf{s=5:}\qquad (J_{abcde})^2 \;-\; \frac{10}{d+5}\,\frac{(ML)^2-(d+5)}{(ML)^2-(d+4)}\;(J'_{abc})^2 + \frac{15}{(d+3)(d+5)}\,\frac{(ML)^4-4(ML)^2(d+3)+3(d+3)(d+5)}{[(ML)^2-(d+4)][(ML)^2-3(d+2)]}\;(J''_{a})^2$$

1-10/15*(44-15)/(44-14)+15/(13*15)*((44^2-4*44*13+3(13*15)))/(((44-14)(44-3*12)))

Input:

$$1-\frac{10}{15}\times\frac{44-15}{44-14}+\frac{15}{13\times15}\times\frac{44^2-4\times44\times13+3\,(13\times15)}{(44-14)\,(44-3\times12)}$$

Exact result:

$$\frac{4027}{9360}$$

Decimal approximation:

0.430235042735042735042735042735042735042735042735042735042...

0.430235042735

$$s=6: \quad (J_{abcdef})^2 - \frac{15}{d+7}\frac{(ML)^2-(d+7)}{(ML)^2-(d+6)}\left(J'^{abcd}\right)^2 + \frac{45}{(d+5)(d+7)}\frac{(ML)^4-4(ML)^2(d+5)+3(d+5)(d+7)}{[(ML)^2-(d+6)][(ML)^2-3(d+4)]}\left(J''_{ab}\right)^2 - \frac{15[(ML)^6-(ML)^4(9d+31)+23(ML)^2(d+3)(d+5)-15(d+3)(d+5)(d+7)]}{(d+3)(d+5)(d+7)[(ML)^2-(d+6)][(ML)^2-3(d+4)][(ML)^2-5(d+2)]}\left(J'''\right)^2 \tag{7.56}$$

Input:

$$1-\frac{15}{17}\times\frac{60-17}{60-16}+\frac{45}{15\times17}\times\frac{60^2-4\times60\times15+3\times15\times17}{(60-16)(60-3\times14)}-\frac{15\times60^3-60^2(90+31)+23\times60(13\times15)-15(13\times15\times17)}{(13\times15\times17)(60-16)(60-3\times14)(60-5\times12)}$$

Result:

$\tilde{\infty}$

$$s-7: \quad (J_{abcdefg})^2 - \frac{21}{d+9}\frac{(ML)^2-(d+9)}{(ML)^2-(d+8)}\left(J'^{abcde}\right)^2 + \frac{105}{(d+7)(d+9)}\frac{(ML)^4-4(ML)^2(d+7)+3(d+7)(d+9)}{[(ML)^2-(d+8)][(ML)^2-3(d+6)]}\left(J''_{abc}\right)^2 - \frac{105[(ML)^6-(ML)^4(9d+49)+23(ML)^2(d+5)(d+7)-15(d+5)(d+7)(d+9)]}{(d+5)(d+7)(d+9)|(ML)^2\quad(d+8)||(ML)^2\quad3(d+6)||(ML)^2\quad5(d+4)|}\left(J'''_{a}\right)^2 \tag{7.57}$$

Input:

$$1-\frac{21}{19}\times\frac{78-19}{78-18}+\frac{105}{17\times19}\times\frac{78^2-4\times78\times17+3\times17\times19}{78-18}(78-3\times16)-\frac{105\times78^3-78^2(90+49)+23\times78\times15\times17-15\times15\times17\times19}{15\times17(19(78-18))(78-3\times16)}(78-5\times14)$$

Exact result:

$$\frac{115\,750\,751}{484\,500}$$

Decimal approximation:

238.907638802889576883384932920536635706914344685242518059 8...

238.9076388…

From the sum of the results, we obtain:

(1+0.76136+0.430235042735+238.9076388)

Input interpretation:

$1 + 0.76136 + 0.430235042735 + 238.9076388$

Result:

241.099233842735

241.099233842735

(1+0.76136+0.430235042735+238.9076388)*17-((sqrt5+1)/2)^2

Input interpretation:

$(1 + 0.76136 + 0.430235042735 + 238.9076388) \times 17 - \left(\frac{1}{2}\left(\sqrt{5} + 1\right)\right)^2$

Result:

4096.0689...

4096.0689… ≈ 4096 = 64^2

Input interpretation:

$(1 + 0.76136 + 0.430235042735 + 238.9076388) \times 17 - \phi^2$

ϕ is the golden ratio

Result:

4096.0689...

4096.0689…. as above

Alternative representations:

$$(1 + 0.76136 + 0.4302350427350000 + 238.908)\,17 - \phi^2 = 4098.69 - (2\sin(54^\circ))^2$$

$$(1 + 0.76136 + 0.4302350427350000 + 238.908)\,17 - \phi^2 = 4098.69 - (-2\cos(216^\circ))^2$$

$$(1 + 0.76136 + 0.4302350427350000 + 238.908)\,17 - \phi^2 = 4098.69 - (-2\sin(666^\circ))^2$$

sqrt(((((1+0.76136+0.430235042735+238.9076388)*17-((sqrt5+1)/2)^2))))

Input interpretation:

$$\sqrt{(1 + 0.76136 + 0.430235042735 + 238.9076388) \times 17 - \left(\frac{1}{2}\left(\sqrt{5} + 1\right)\right)^2}$$

Result:

64.0005386...

64.0005386… $\approx 8^2$

From:

Unconstrained Higher Spins of Mixed Symmetry II. Fermi Fields –
A. Campoleoni, D. Francia, J. Mourad and A. Sagnotti -
arXiv:0904.4447v2 [hep-th] 1 Sep 2009

We have that:

As we already noticed, the second condition in eq. (2.111) annihilates the $\{2,1\}$ combinations of the shift parameters, so that one can conveniently rewrite the relations directly in terms of the fully symmetric $\widehat{\Omega}_{ijk}$. This was done in eq. (2.112), whose first line contains a square system of equations for the four $\widehat{\Omega}_{ijk}$ that are available in the two-family case:

$$\begin{aligned}
&(D+2s_1-6)\,\widehat{\Omega}_{111}+2L_-\,\widehat{\Omega}_{112}=0\,,\\
&2L_+\,\widehat{\Omega}_{111}+(3D+4s_1+2s_2-10)\,\widehat{\Omega}_{112}+4L_-\,\widehat{\Omega}_{122}=0\,,\\
&4L_+\,\widehat{\Omega}_{112}+(3D+2s_1+4s_2-10)\,\widehat{\Omega}_{122}+2L_-\,\widehat{\Omega}_{222}=0\,,\\
&2L_+\,\widehat{\Omega}_{122}+(D+2s_2-6)\,\widehat{\Omega}_{222}=0\,.
\end{aligned}\tag{2.153}$$

One can solve this system after multiplying the equations by suitable powers of L_- in order to convert them into others characterized by the same value of m. The operation corresponds to performing some symmetrizations, in order that all equations finally carry like sets of symmetric space-time indices. However, these sets can be displaced in different positions on the same parameter, so that for instance for a rank $(4,2)$ field ψ the two distinct combinations

the system (2.153) reduces to the following chain of square systems of equations labeled by n:

$$\begin{aligned}
&(D+2s_1-6)\,\widehat{\Omega}_{111}+2L_-\,\widehat{\Omega}_{112}=0\,,\\
&2(n-s_1+2)(n-s_2)\,\widehat{\Omega}_{111}+(3D+4s_1+2s_2-10)\,L_-\,\widehat{\Omega}_{112}+4L_-^2\,\widehat{\Omega}_{122}=0\,,\\
&4(n-s_1+1)(n-s_2+1)\,L_-\,\widehat{\Omega}_{112}+(3D+2s_1+4s_2-10)\,L_-^2\,\widehat{\Omega}_{122}+2L_-^3\,\widehat{\Omega}_{222}=0\,,\\
&2(n-s_1)(n-s_2+2)\,L_-^2\,\widehat{\Omega}_{122}+(D+2s_2-6)\,L_-^3\,\widehat{\Omega}_{222}=0\,.
\end{aligned}\tag{2.155}$$

Their determinants read

$$\begin{aligned}
&(D+2n-2)(3D+4(s_1+s_2)-2n-18)(D+2(s_1+s_2)-2n-6)\\
&\times(3D+2(s_1+s_2)+2n-14)\,,
\end{aligned}\tag{2.156}$$

and vanish if and only if $D=2$ and $n=0$, since $0\le n\le s_2$ and the whole system is available only if $s_1\ge 3$ and $s_2\ge 3$, and in the remaining degenerate cases no new solutions emerge. In $D=2$, the $n=0$ system has rank three and admits the solution

$s_1 = 2$ and $s_2 = 1$ in D = 2 and for $s_1 = 1$ and $s_2 = 1$ in D = 3

From eq. (2.156)

$$\begin{aligned}
&(D+2n-2)(3D+4(s_1+s_2)-2n-18)(D+2(s_1+s_2)-2n-6)\\
&\times(3D+2(s_1+s_2)+2n-14)\,,
\end{aligned}$$

for n = 2, $s_1 = s_2 = 3$, D = 2, 4, 10

we obtain:

(2+2*2-2)(3*2+4(3+3)-2*2-18)(2+2(3+3)-2*2-6)*(3*2+2(3+3)+2*2-14)

Input:

$$(2+2\times2-2)(3\times2+4(3+3)-2\times2-18)$$
$$((2+2(3+3)-2\times2-6)(3\times2+2(3+3)+2\times2-14))$$

Result:

1024

1024 = 64*16

(4+2*2-2)(3*4+4(3+3)-2*2-18)(4+2(3+3)-2*2-6)*(3*4+2(3+3)+2*2-14)

Input:

$$(4+2\times2-2)(3\times4+4(3+3)-2\times2-18)$$
$$((4+2(3+3)-2\times2-6)(3\times4+2(3+3)+2\times2-14))$$

Result:

7056

7056 = 8*882

(10+2*2-2)(10*3+4(3+3)-2*2-18)(10+2(3+3)-2*2-6)*(10*3+2(3+3)+2*2-14)

Input:

$$(10+2\times2-2)(10\times3+4(3+3)-2\times2-18)$$
$$((10+2(3+3)-2\times2-6)(10\times3+2(3+3)+2\times2-14))$$

Result:

147456

147456 = 64*2304

We note that:

(((10+2*2-2)(10*3+4(3+3)-2*2-18)(10+2(3+3)-2*2-6)*(10*3+2(3+3)+2*2-14)))/18

Input:

$$\frac{1}{18}((10+2\times2-2)(10\times3+4(3+3)-2\times2-18)$$
$$((10+2(3+3)-2\times2-6)(10\times3+2(3+3)+2\times2-14)))$$

Result:

8192

8192 = 2*64^2

Now, we have that:

$$E_{\bar{\psi}}^{constr}: \ \mathcal{E}_{\psi} + \frac{1}{18\,(3D+4)} \left\{ \frac{6}{3D-2}\, \eta_{(\mu_1\mu_2}\, \gamma_{\mu_3)} \left[4\, u_{\nu_1\nu_2} - (3D+2)\, v_{(\nu_1\,,\nu_2)} \right] \right.$$
$$+ \frac{2}{3D-2} \left(\eta_{(\mu_1\mu_2|}\, \gamma_{(\nu_1|} + \eta_{(\nu_1|(\mu_1}\, \gamma_{\mu_2|} \right) \left[3\, D\, u_{|\mu_3)\,|\nu_2)} - 2\, v_{|\mu_3)\,,|\nu_2)} - 2\, v_{|\nu_2)\,,|\mu_3)} \right]$$
$$- \frac{2}{3D-2} \left(\eta_{\nu_1\nu_2} \gamma_{(\mu_1|} + \gamma_{(\nu_1} \eta_{\nu_2)\,(\mu_1|} \right) \left[2\,(3D+2)\, u_{|\mu_2\mu_3)} - 3\,(D+2)\, v_{|\mu_2\,,\mu_3)} \right]$$
$$\left. + \frac{1}{D^2-2} \left(2\, \eta_{\nu_1\nu_2}\, \eta_{(\mu_1\mu_2}\, \omega_{\mu_3)} - \eta_{\nu_1(\mu_1}\, \eta_{\mu_2|\,\nu_1}\, \omega_{|\mu_3)} \right) \right\} = 0\,.$$

(2.180)

For D = 4, we obtain:

1+1/(18*16)*[6/10(4-14)+2/10*2*(3*4-2-2)-2/10*2*(2*14-3*6)+1/14*2-1]

Input:

$$1 + \frac{1}{18 \times 16} \left(\frac{6}{10} (4 - 14) + \frac{2}{10} \times 2\,(3 \times 4 - 2 - 2) - \frac{2}{10} \times 2\,(2 \times 14 - 3 \times 6) + \frac{1}{14} \times 2 - 1 \right)$$

Exact result:

$$\frac{2453}{2520}$$

Decimal approximation:

0.973412698412698412698412698412698412698412698412698412698...

Repeating decimal:

$0.97\overline{3412698}$ (period 6)

0.973412698 result very near to the spectral index n_s , to the mesonic Regge slope, to the inflaton value at the end of the inflation 0.9402 and to the value of the following Rogers-Ramanujan continued fraction:

$$\frac{e^{-\frac{\pi}{5}}}{\sqrt{(\varphi-1)\sqrt{5}}-\varphi+1}=1-\cfrac{e^{-\pi}}{1+\cfrac{e^{-2\pi}}{1+\cfrac{e^{-3\pi}}{1+\cfrac{e^{-4\pi}}{1+\ldots}}}}\approx 0.9568666373$$

= 0.9568666373

From:

Astronomy & Astrophysics manuscript no. ms c ESO 2019 - September 24, 2019
Planck 2018 results. VI. Cosmological parameters

The primordial fluctuations are consistent with Gaussian purely adiabatic scalar perturbations characterized by a power spectrum with a spectral index n_s = 0.965 ± 0.004, consistent with the predictions of slow-roll, single-field, inflation.

We know that α' is the Regge slope (string tension). With regard the Omega mesons, the values are:

ω	6	$m_{u/d}=0-60$	$0.910-0.918$	
	ω/ω_3	$5+3$	$m_{u/d}=255-390$	$0.988-1.18$
	ω/ω_3	$5+3$	$m_{u/d}=240-345$	$0.937-1.000$
Ψ	3	$m_c=1500$	0.979	−0.09

From:

$$\mathcal{Y}^{(1)}_{T\,\nu_1\nu_2} = \frac{1}{6\,(3D+4)}\left\{\frac{4}{3D-2}\left[4\,u_{\nu_1\nu_2} \quad (3D \mid 2)\,v_{(\nu_1,\nu_2)}\right] \mid \frac{\rho_0}{D^2-2}\,\gamma_{(\nu_1}\,\omega_{\nu_2)}\right\},$$

$$\mathcal{Y}^{(2)}_{T\,\mu,\nu} = -\frac{1}{18\,(3D+4)}\left\{\frac{4}{3D-2}\left[3\,\rho_0\,u_{\mu\nu} - 2\,v_{(\mu,\nu)}\right] - \frac{\rho_0}{D^2-2}\,\gamma_{(\mu}\,\omega_{\nu)}\right\}, \qquad (2.195)$$

$$\mathcal{Y}^{(3)}_{T\,\mu_1\mu_2} = \frac{1}{18\,(3D+4)}\left\{\frac{8}{3D-2}\left[(3D+2)\,u_{\mu_1\mu_2} - \frac{3}{2}\,\rho_2\,v_{(\mu_1,\mu_2)}\right] - \frac{\rho_0}{D^2-2}\,\gamma_{(\mu_1}\,\omega_{\mu_2)}\right\}.$$

We obtain for D = 4:

-1/(6*16) * [4/(12-2) (4-14)+1/(16-2)]

-1/(18*16) * [4/(12-2) (3-2)-1/(16-2)]

1/(18*16) * [8/(12-2) (14-3/2)-1/(16-2)]

(((1/(6*16) * -[4/(12-2) (4-14)+1/(16-2)])) + (((1/(18*16) * -[4/(12-2) (3-2)-1/(16-2)])) + (((1/(18*16) * [8/(12-2) (14-3/2)-1/(16-2)]))

Input:

$$\frac{1}{6\times16}\times(-1)\left(\frac{4}{12-2}(4-14)+\frac{1}{16-2}\right)+$$
$$\frac{1}{18\times16}\times(-1)\left(\frac{4}{12-2}(3-2)-\frac{1}{16-2}\right)+\frac{1}{18\times16}\left(\frac{8}{12-2}\left(14-\frac{3}{2}\right)-\frac{1}{16-2}\right)$$

Exact result:

$$\frac{499}{6720}$$

Decimal approximation:

0.074255952380952380952380952380952380952380952380952380952...

Repeating decimal:

$0.074255\overline{952380}$ (period 6)

0.074255952380

From which, we obtain:

4*(((-[(((1/(6*16) * -[4/(12-2) (4-14)+1/(16-2)]))) *1/ (((1/(18*16) * -[4/(12-2) (3-2)-1/(16-2)]))) * 1/(((1/(18*16) * [8/(12-2) (14-3/2)-1/(16-2)])))+16]-2/5)))-1/3

Input:

$$4\left(-\left(\left(\frac{1}{6\times 16}\times(-1)\left(\frac{4}{12-2}(4-14)+\frac{1}{16-2}\right)\right)\times\frac{1}{\frac{1}{18\times 16}\times(-1)\left(\frac{4}{12-2}(3-2)-\frac{1}{16-2}\right)}\times\frac{1}{\frac{1}{18\times 16}\left(\frac{8}{12-2}\left(14-\frac{3}{2}\right)-\frac{1}{16-2}\right)}+16\right)-\frac{2}{5}\right)-\frac{1}{3}$$

Exact result:

$$\frac{196\,422\,167}{47\,955}$$

Decimal approximation:

4095.968449588155562506516525909707016995099572515900323219...

4095.9684495… ≈ 4096 = 64^2

and:

sqrt((((4*(((-[(((1/(6*16) * -[4/(12-2) (4-14)+1/(16-2)]))) *1/ (((1/(18*16) * -[4/(12-2) (3-2)-1/(16-2)]))) * 1/(((1/(18*16) * [8/(12-2) (14-3/2)-1/(16-2)])))+16]-2/5)))-1/3))))

Input:

$$\sqrt{\left(4\left(-\left(\left(\frac{1}{6\times 16}\times(-1)\left(\frac{4}{12-2}(4-14)+\frac{1}{16-2}\right)\right)\times\frac{1}{\frac{1}{18\times 16}\times(-1)\left(\frac{4}{12-2}(3-2)-\frac{1}{16-2}\right)}\times\frac{1}{\frac{1}{18\times 16}\left(\frac{8}{12-2}\left(14-\frac{3}{2}\right)-\frac{1}{16-2}\right)}+16\right)-\frac{2}{5}\right)-\frac{1}{3}\right)}$$

Exact result:

$$\sqrt{\frac{196\,422\,167}{47\,955}}$$

Decimal approximation:

63.999753511932806212793652883347591455467918218361286234 04...

63.999753511… ≈ 64 = 8^2

From:

$$N_{\text{d.o.f.}} = 2^{\left[\frac{D-2}{2}\right]} \frac{s_1 - s_2 + 1}{(s_1+1)!\,s_2!} \frac{(D+s_1-5)!}{(D-4)!} \frac{(D+s_2-6)!}{(D-6)!} (D+s_1+s_2-4), \qquad (4.16)$$

For D = 10, $s_1 = s_2 = 3$, we obtain:

$$2^{\left[\frac{D-2}{2}\right]} \frac{s_1 - s_2 + 1}{(s_1+1)!\,s_2!} \frac{(D+s_1-5)!}{(D-4)!} \frac{(D+s_2-6)!}{(D-6)!} (D+s_1+s_2-4)$$

2^4 (1)/((3+1)! 3!) * (10+3-5)! / (10-4)! * (10+3-6)! / (10-6)! * (10+3+3-4)

Input:

$$2^4 \times \frac{1}{(3+1)! \times 3!} \times \frac{(10+3-5)!}{(10-4)!} \times \frac{(10+3-6)!}{(10-6)!} (10+3+3-4)$$

$n!$ is the factorial function

Result:

15 680

15680 = 245 * 8^2

From which:

1/245 * 2^((10-2)/2) (1)/((3+1)! 3!) * (10+3-5)! / (10-4)! * (10+3-6)! / (10-6)! * (10+3+3-4)

Input:

$$\frac{1}{245} \times 2^{(10-2)/2} \left(\frac{1}{(3+1)! \times 3!} \times \frac{(10+3-5)!}{(10-4)!} \times \frac{(10+3-6)!}{(10-6)!} (10+3+3-4) \right)$$

$n!$ is the factorial function

Exact result:

64

$64 = 8^2$

Alternative representations:

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \frac{12\,\Gamma(8)\,\Gamma(9)\,2^4}{245\,\Gamma(5)\,(\Gamma(4)\,\Gamma(5))\,\Gamma(7)}$$

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \frac{12\times 6!!\,(7!!)^2\,8!!\times 2^4}{245\,(3!!\times 4!!)\,(2!!\,(3!!)^2\,4!!)\,(5!!\times 6!!)}$$

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \frac{12\,\Gamma(8,0)\,\Gamma(9,0)\,2^4}{245\,\Gamma(5,0)\,(\Gamma(4,0)\,\Gamma(5,0))\,\Gamma(7,0)}$$

Series representation:

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \frac{192\sum_{k_1=0}^{\infty}\sum_{k_2=0}^{\infty}\frac{(7-n_0)^{k_1}\,(8-n_0)^{k_2}\,\Gamma^{(k_1)}(1+n_0)\,\Gamma^{(k_2)}(1+n_0)}{k_1!\,k_2!}}{245\left(\sum_{k=0}^{\infty}\frac{(3-n_0)^k\,\Gamma^{(k)}(1+n_0)}{k!}\right)\left(\sum_{k=0}^{\infty}\frac{(4-n_0)^k\,\Gamma^{(k)}(1+n_0)}{k!}\right)^2\sum_{k=0}^{\infty}\frac{(6-n_0)^k\,\Gamma^{(k)}(1+n_0)}{k!}}$$

for $((n_0 \geq 0$ or $n_0 \notin \mathbb{Z})$ and $n_0 \to 3$ and $n_0 \to 4$ and $n_0 \to 6$ and $n_0 \to 7$ and $n_0 \to 8)$

Integral representations:

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \int_0^1\int_0^1 \log^7\left(\frac{1}{t_1}\right)\log^8\left(\frac{1}{t_2}\right)dt_2\,dt_1$$

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} = \frac{192\left(\int_0^\infty e^{-t}\,t^7\,dt\right)\int_0^\infty e^{-t}\,t^8\,dt}{245\left(\int_0^\infty e^{-t}\,t^3\,dt\right)\left(\int_0^\infty e^{-t}\,t^4\,dt\right)^2\int_0^\infty e^{-t}\,t^6\,dt}$$

$$\frac{2^{(10-2)/2}\,((10+3-5)!\,(10+3-6)!\,(10+3+3-4))}{((10-4)!\,((3+1)!\,3!)\,(10-6)!)\,245} =$$
$$\left(192\left(\int_1^\infty e^{-t}\,t^7\,dt+\sum_{k=0}^{\infty}\frac{(-1)^k}{(8+k)\,k!}\right)\left(\int_1^\infty e^{-t}\,t^8\,dt+\sum_{k=0}^{\infty}\frac{(-1)^k}{(9+k)\,k!}\right)\right)\Big/$$
$$\left(245\left(\int_1^\infty e^{-t}\,t^3\,dt+\sum_{k=0}^{\infty}\frac{(-1)^k}{(4+k)\,k!}\right)\right.$$
$$\left.\left(\int_1^\infty e^{-t}\,t^4\,dt+\sum_{k=0}^{\infty}\frac{(-1)^k}{(5+k)\,k!}\right)^2\left(\int_1^\infty e^{-t}\,t^6\,dt+\sum_{k=0}^{\infty}\frac{(-1)^k}{(7+k)\,k!}\right)\right)$$

(((1/245 * 2^((10-2)/2) (1)/((3+1)! 3!) * (10+3-5)! / (10-4)! * (10+3-6)! / (10-6)! * (10+3+3-4))))^2

Input:

$$\left(\frac{1}{245}\times 2^{(10-2)/2}\left(\frac{1}{(3+1)!\times 3!}\times\frac{(10+3-5)!}{(10-4)!}\times\frac{(10+3-6)!}{(10-6)!}\,(10+3+3-4)\right)\right)^2$$

$n!$ is the factorial function

Exact result:

4096

$4096 = 64^2$

2*(((1/245 * 2^((10-2)/2) (1)/((3+1)! 3!) * (10+3-5)! / (10-4)! * (10+3-6)! / (10-6)! * (10+3+3-4))))^2

Input:

$$2\left(\frac{1}{245}\times 2^{(10-2)/2}\left(\frac{1}{(3+1)!\times 3!}\times\frac{(10+3-5)!}{(10-4)!}\times\frac{(10+3-6)!}{(10-6)!}\,(10+3+3-4)\right)\right)^2$$

$n!$ is the factorial function

Exact result:

8192

$8192 = 2*64^2$

We have also:

(((2^4 (1)/((3+1)! 3!) * (10+3-5)! / (10-4)! * (10+3-6)! / (10-6)! * (10+3+3-4))))^1/20

Input:

$$\sqrt[20]{2^4 \times \frac{1}{(3+1)! \times 3!} \times \frac{(10+3-5)!}{(10-4)!} \times \frac{(10+3-6)!}{(10-6)!} (10+3+3-4)}$$

$n!$ is the factorial function

Exact result:

$$2^{3/10} \sqrt[20]{5} \sqrt[10]{7}$$

Decimal approximation:

1.620941356428276400444068649657152449000004944445301621452...

1.6209413564282764…. result that is a good approximation to the value of the golden ratio 1.618033988749...

Alternate form:

root of $x^{20} - 15\,680$ near $x = 1.62094$

From the two results, we have:

15680; 147456

(15680 + 147456)/64

Input:

$$\frac{15\,680 + 147\,456}{64}$$

Result:

2549

2549 prime number

(15680 + 147456)/(13*3)-89+2

Input:

$$\frac{15\,680 + 147\,456}{13 \times 3} - 89 + 2$$

Exact result:

$$\frac{159\,743}{39}$$

Decimal approximation:

4095.974358974358974358974358974358974358974358974358...

4095.9743589… ≈ 4096 = 64^2

((15680 + 147456)/64)^1/16

Input:

$$\sqrt[16]{\frac{15\,680 + 147\,456}{64}}$$

Result:

$$\sqrt[16]{2549}$$

Decimal approximation:

1.632668879603572110757987754374082631351325961562098106889...

1.63266887….≈ $\zeta(2) = \frac{\pi^2}{6} = 1.644934$ ...

((15680 + 147456)/64)-843+29-7

where 843, 29 and 7 are Lucas numbers

Input:

$$\frac{15\,680 + 147\,456}{64} - 843 + 29 - 7$$

Result:

1728
1728

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)

(147456*15680)*1/8192*1/128

Input:

$$(147\,456 \times 15\,680) \times \frac{1}{8192} \times \frac{1}{128}$$

Exact result:

2205
2205

((147456*15680)*1/8192*1/128)^1/16

Input:

$$\sqrt[16]{(147\,456 \times 15\,680) \times \frac{1}{8192} \times \frac{1}{128}}$$

Result:

$\sqrt[16]{5}\ \sqrt[8]{21}$

Decimal approximation:

1.617942328398768124579792247441208973161961514287519584666...
1.617942328…. result that is a very good approximation to the value of the golden ratio 1.618033988749...

((147456*15680)*1/8192*1/128)*golden ratio^2+18

Input:

$$\left((147\,456 \times 15\,680) \times \frac{1}{8192} \times \frac{1}{128}\right)\phi^2 + 18$$

ϕ is the golden ratio

Result:

$$2205\,\phi^2 + 18$$

Decimal approximation:

5790.764945193518140291113969776232049573281741471707111008...

5790.76494519….result very near to the rest mass of bottom Xi baryon 5787.8

Alternate forms:

$$\frac{9}{2}\left(739 + 245\sqrt{5}\right)$$

$$9\,(245\,\phi^2 + 2)$$

$$\frac{6651}{2} + \frac{2205\sqrt{5}}{2}$$

Alternative representations:

$$\frac{\phi^2\,(147\,456 \times 15\,680)}{8192 \times 128} + 18 = 18 + \frac{2\,312\,110\,080\,(2\sin(54^\circ))^2}{128 \times 8192}$$

$$\frac{\phi^2\,(147\,456 \times 15\,680)}{8192 \times 128} + 18 = 18 + \frac{2\,312\,110\,080\,(-2\cos(216^\circ))^2}{128 \times 8192}$$

$$\frac{\phi^2\,(147\,456 \times 15\,680)}{8192 \times 128} + 18 = 18 + \frac{2\,312\,110\,080\,(-2\sin(666^\circ))^2}{128 \times 8192}$$

((147456*15680)*1/8192*1/128)*golden ratio^2+18-4096+34+(sqrt2)/5

Input:

$$\left((147\,456 \times 15\,680) \times \frac{1}{8192} \times \frac{1}{128}\right)\phi^2 + 18 - 4096 + 34 + \frac{\sqrt{2}}{5}$$

ϕ is the golden ratio

Result:

$$2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}$$

Decimal approximation:

1729.047787905992759300874307521073989188995675846782500623...

1729.0477879…

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)

Alternate forms:

$$\frac{1}{10}\left(-7365 + 2\sqrt{2} + 11\,025\sqrt{5}\right)$$

$$\frac{1}{5}\left(11\,025\,\phi^2 - 20\,220 + \sqrt{2}\right)$$

$$\frac{1}{10}\left(\sqrt{607\,753\,133 + 44\,100\sqrt{10}} - 7365\right)$$

Minimal polynomial:

$$625\,x^4 + 1\,841\,250\,x^3 - 5\,562\,793\,225\,x^2 - 10\,191\,501\,181\,050\,x + 19\,148\,324\,925\,379\,279$$

Series representations:

$$\frac{\phi^2\,(147456\times 15680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}=$$
$$-4044+2205\,\phi^2+\frac{1}{5}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(2-z_0)^k\,z_0^{-k}}{k!}$$
for $(\text{not}\ (z_0\in\mathbb{R}\ \text{and}\ -\infty<z_0\le 0))$

$$\frac{\phi^2\,(147456\times 15680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}=-4044+2205\,\phi^2+$$
$$\frac{1}{5}\exp\left(i\pi\left\lfloor\frac{\arg(2-x)}{2\pi}\right\rfloor\right)\sqrt{x}\sum_{k=0}^{\infty}\frac{(-1)^k\,(2-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\quad\text{for}\ (x\in\mathbb{R}\ \text{and}\ x<0)$$

$$\frac{\phi^2\,(147456\times 15680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}=-4044+2205\,\phi^2+$$
$$\frac{1}{5}\left(\frac{1}{z_0}\right)^{1/2\,[\arg(2-z_0)/(2\pi)]}\,z_0^{1/2\,(1+[\arg(2-z_0)/(2\pi)])}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(2-z_0)^k\,z_0^{-k}}{k!}$$

[((147456*15680)*1/8192*1/128)*golden ratio^2+18-4096+34+(sqrt2)/5]^1/15

Input:

$$\sqrt[15]{\left((147456\times 15680)\times\frac{1}{8192}\times\frac{1}{128}\right)\phi^2+18-4096+34+\frac{\sqrt{2}}{5}}$$

ϕ is the golden ratio

Exact result:

$$\sqrt[15]{2205\,\phi^2-4044+\frac{\sqrt{2}}{5}}$$

Decimal approximation:

1.643818257608355116310067959419967599823519032770053078362...

$1.643818257\ldots\approx\zeta(2)=\frac{\pi^2}{6}=1.644934\ldots$

Alternate forms:

$$\sqrt[15]{\frac{1}{5}\left(11\,025\,\phi^2 - 20\,220 + \sqrt{2}\right)}$$

$$\sqrt[15]{\frac{1}{10}\left(\sqrt{607\,753\,133 + 44\,100\sqrt{10}} - 7365\right)}$$

$$\sqrt[15]{\frac{1}{10}\left(-7365 + 2\sqrt{2} + 11\,025\sqrt{5}\right)}$$

Minimal polynomial:

$$625\,x^{60} + 1\,841\,250\,x^{45} - 5\,562\,793\,225\,x^{30} - 10\,191\,501\,181\,050\,x^{15} + 19\,148\,324\,925\,379\,279$$

All 15th roots of 2205 ϕ^2 - 4044 + sqrt(2)/5:

$$e^0\sqrt[15]{2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}} \approx 1.6438 \text{ (real, principal root)}$$

$$e^{(2\,i\,\pi)/15}\sqrt[15]{2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}} \approx 1.5017 + 0.6686\,i$$

$$e^{(4\,i\,\pi)/15}\sqrt[15]{2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}} \approx 1.0999 + 1.2216\,i$$

$$e^{(2\,i\,\pi)/5}\sqrt[15]{2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}} \approx 0.5080 + 1.5634\,i$$

$$e^{(8\,i\,\pi)/15}\sqrt[15]{2205\,\phi^2 - 4044 + \frac{\sqrt{2}}{5}} \approx -0.17183 + 1.6348\,i$$

Series representations:

$$\sqrt[15]{\frac{\phi^2\,(147\,456\times 15\,680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}}=\sqrt[15]{-4044+2205\,\phi^2+\frac{1}{5}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(2-z_0)^k\,z_0^{-k}}{k!}}$$

for $\left(\text{not}\left(z_0\in\mathbb{R}\text{ and }-\infty<z_0\le 0\right)\right)$

$$\sqrt[15]{\frac{\phi^2\,(147\,456\times 15\,680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}}=\sqrt[15]{-4044+2205\,\phi^2+\frac{1}{5}\exp\left(i\,\pi\left\lfloor\frac{\arg(2-x)}{2\,\pi}\right\rfloor\right)\sqrt{x}\sum_{k=0}^{\infty}\frac{(-1)^k\,(2-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}}$$

for $(x\in\mathbb{R}\text{ and }x<0)$

$$\sqrt[15]{\frac{\phi^2\,(147\,456\times 15\,680)}{8192\times 128}+18-4096+34+\frac{\sqrt{2}}{5}}=\left(-4044+2205\,\phi^2+\frac{1}{5}\left(\frac{1}{z_0}\right)^{1/2\,\lfloor\arg(2-z_0)/(2\,\pi)\rfloor}z_0^{1/2+1/2\,\lfloor\arg(2-z_0)/(2\,\pi)\rfloor}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(2-z_0)^k\,z_0^{-k}}{k!}\right)\text{^}\,(1/15)$$

Integral representation:

$$(1+z)^a=\frac{\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\Gamma(s)\,\Gamma(-a-s)}{z^s}\,ds}{(2\,\pi\,i)\,\Gamma(-a)}\quad\text{for}\ (0<\gamma<-\mathrm{Re}(a)\text{ and }|\arg(z)|<\pi)$$

From:

Unconstrained Higher Spins of Mixed Symmetry I. Bose Fields - *A. Campoleoni, D. Francia, J. Mourad and A. Sagnotti* - arXiv:0810.4350v2 [hep-th] 18 Dec 2008

Now, we have that:

The Lagrangian for unprojected fields of rank $(4,2)$ thus reads

$$\begin{aligned}\mathcal{L} &= \frac{1}{2}\,\varphi^{\mu_1\dots\mu_4;\nu_1\nu_2}\,(\mathcal{E}_\varphi)_{\mu_1\dots\mu_4;\nu_1\nu_2}\\ &\quad - 3\,\alpha^{(1)\,\mu;\nu_1\nu_2}\,\partial^\lambda\left\{\mathcal{A}'^{\mu}{}_{\lambda\mu;\nu_1\nu_2} - \frac{1}{6}\,\eta_{\nu_1\nu_2}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{\mu\lambda}\right\}\\ &\quad - 3\,\alpha^{(2)\,\mu_1\mu_2;\nu}\,\partial^\lambda\left\{\left(\mathcal{A}'^{\mu}{}_{\mu_1\mu_2;\nu\lambda} + 2\,\mathcal{A}^{\hat{\imath}}{}_{\lambda\mu_1\mu_2;\nu}\right) + \frac{1}{6}\,\eta_{\nu(\mu_1|}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_2)\lambda}\right\}\\ &\quad - \alpha^{(3)\,\mu_1\mu_2\mu_3}\,\partial^\lambda\left\{\left(\mathcal{A}'^{\nu}{}_{\lambda\mu_1\mu_2\mu_3} + 2\,\mathcal{A}^{\hat{\imath}}{}_{\mu_1\mu_2\mu_3;\lambda}\right) - \frac{1}{6}\,\eta_{(\mu_1\mu_2|}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_3)\lambda}\right\}\\ &\quad + 3\,\beta^{(1)\,\nu_1\nu_2}\,\mathcal{C}^{(1)}{}_{\nu_1\nu_2} + 24\,\beta^{(2)\,\mu;\nu}\,\mathcal{C}^{(2)}{}_{\mu;\nu} + 18\,\beta^{(3)\,\mu_1\mu_2}\,\mathcal{C}^{(3)}{}_{\mu_1\mu_2}\,,\end{aligned} \tag{2.164}$$

with

$$\begin{aligned}\mathcal{E}_\varphi &= \mathcal{A}_{\mu_1\dots\mu_4;\nu_1\nu_2}\\ &\quad - \frac{1}{2}\,\eta_{(\mu_1\mu_2}\,\mathcal{A}'^{\mu}{}_{\mu_3\mu_4);\nu_1\nu_2} - \frac{1}{2}\,\eta_{(\nu_1|(\mu_1}\,\mathcal{A}^{\hat{\imath}}{}_{\mu_2\mu_3\mu_4);|\nu_2)} - \frac{1}{2}\,\eta_{\nu_1\nu_2}\,\mathcal{A}'^{\nu}{}_{\mu_1\dots\mu_4}\\ &\quad + \frac{1}{18}\left(2\,\eta_{\nu_1\nu_2}\,\eta_{(\mu_1\mu_2|} - \eta_{\nu_1(\mu_1}\eta_{\mu_2|\nu_2)}\right)\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_3\mu_4)}\,.\end{aligned} \tag{2.165}$$

We obtain, from eq. (2.165):

$$\begin{aligned}\mathcal{E}_\varphi &= \mathcal{A}_{\mu_1\dots\mu_4;\nu_1\nu_2}\\ &\quad - \frac{1}{2}\,\eta_{(\mu_1\mu_2}\,\mathcal{A}'^{\mu}{}_{\mu_3\mu_4);\nu_1\nu_2} - \frac{1}{2}\,\eta_{(\nu_1|(\mu_1}\,\mathcal{A}^{\hat{\imath}}{}_{\mu_2\mu_3\mu_4);|\nu_2)} - \frac{1}{2}\,\eta_{\nu_1\nu_2}\,\mathcal{A}'^{\nu}{}_{\mu_1\dots\mu_4}\\ &\quad + \frac{1}{18}\left(2\,\eta_{\nu_1\nu_2}\,\eta_{(\mu_1\mu_2|} - \eta_{\nu_1(\mu_1}\eta_{\mu_2|\nu_2)}\right)\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_3\mu_4)}\,.\end{aligned}$$

Input:

$$1 - \frac{1}{2} - \frac{1}{2} - \frac{1}{2} + \frac{1}{18}\,(2-1)\,(1-1)$$

Exact result:

$$-\frac{1}{2}$$

Decimal form:

-0.5

-0.5

Those particles with half-integer spins, such as 1/2, 3/2, 5/2, are known as fermions, while those particles with integer spins, such as 0, 1, 2, are known as bosons. With regard the electron, we have that: the Spin is 1/2 while the Weak isospin is LH: -1/2, RH: 0

Furthermore, we know that in mathematics, the **Riemann hypothesis** is a conjecture that the Riemann zeta function has its zeros only at the negative even integers and complex numbers with real part 1/2

From eq. (2.164), we obtain:

$$\begin{aligned}\mathcal{L} = & \frac{1}{2}\,\varphi^{\mu_1\ldots\mu_4;\nu_1\nu_2}\,(\mathcal{E}_\varphi)_{\mu_1\ldots\mu_4;\,\nu_1\nu_2} \\ & - 3\,\alpha^{(1)\,\mu\,;\nu_1\nu_2}\,\partial^\lambda\left\{\mathcal{A}'^{\mu}{}_{\lambda\mu\,;\nu_1\nu_2} - \frac{1}{6}\,\eta_{\nu_1\nu_2}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{\mu\lambda}\right\} \\ & - 3\,\alpha^{(2)\,\mu_1\mu_2\,;\nu}\,\partial^\lambda\left\{\left(\mathcal{A}'^{\mu}{}_{\mu_1\mu_2;\nu\lambda} + 2\,\mathcal{A}'^{\hat{\imath}}{}_{\lambda\mu_1\mu_2;\nu}\right) + \frac{1}{6}\,\eta_{\nu(\mu_1|}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_2)\lambda}\right\} \\ & - \alpha^{(3)\,\mu_1\mu_2\mu_3}\,\partial^\lambda\left\{\left(\mathcal{A}'^{\nu}{}_{\lambda\mu_1\mu_2\mu_3} + 2\,\mathcal{A}'^{\hat{\imath}}{}_{\mu_1\mu_2\mu_3;\lambda}\right) - \frac{1}{6}\,\eta_{(\mu_1\mu_2|}\left(\mathcal{A}'^{\mu\prime\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\mu_3)\lambda}\right\} \\ & + 3\,\beta^{(1)\,\nu_1\nu_2}\,\mathcal{C}^{(1)}{}_{\nu_1\nu_2} + 24\,\beta^{(2)\,\mu\,;\nu}\,\mathcal{C}^{(2)}{}_{\mu\,;\nu} + 18\,\beta^{(3)\,\mu_1\mu_2}\,\mathcal{C}^{(3)}{}_{\mu_1\mu_2}\,,\end{aligned}$$

1/2*(-1/2)-3*(1-1/6(1-1))-3*(1+2+1/6(1-1))-1(1+2-1/6(1-1))+3+24+18

Input:

$$\frac{1}{2}\times\frac{1}{2}\times(-1) - 3\left(1 - \frac{1}{6}(1-1)\right) - 3\left(1+2+\frac{1}{6}(1-1)\right) - 1\left(1+2-\frac{1}{6}(1-1)\right) + 3 + 24 + 18$$

Exact result:

$$\frac{119}{4}$$

Decimal form:

29.75

29.75

Now, we have that:

$$E_\varphi = \mathcal{E}_\varphi + \frac{4}{3\,(3\,D^2-8)}\,\eta_{(\mu_1\mu_2}\eta_{\mu_3\mu_4)}\,a_{\nu_1\nu_2} - \frac{1}{3\,(3\,D^2-8)}\,\eta_{(\nu_1|(\mu_1}\eta_{\mu_2\mu_3}\,a_{\mu_4)|\nu_2)} + \frac{2}{9\,(3\,D^2-8)}\,\left(\eta_{\nu_1\nu_2}\eta_{(\mu_1\mu_2|} + \eta_{\nu_1(\mu_1}\eta_{\mu_2|\nu_2}\right)\,a_{|\mu_3\mu_4)} = 0\,, \tag{2.170}$$

For

$$E_\varphi = \mathcal{E}_\varphi + \frac{4}{3\,(3\,D^2-8)}\,\eta_{(\mu_1\mu_2}\eta_{\mu_3\mu_4)}\,a_{\nu_1\nu_2} - \frac{1}{3\,(3\,D^2-8)}\,\eta_{(\nu_1|(\mu_1}\eta_{\mu_2\mu_3}\,a_{\mu_4)|\nu_2)} + \frac{2}{9\,(3\,D^2-8)}\,\left(\eta_{\nu_1\nu_2}\eta_{(\mu_1\mu_2|} + \eta_{\nu_1(\mu_1}\eta_{\mu_2|\nu_2}\right)\,a_{|\mu_3\mu_4)} = 0\,,$$

-0.5+4/(3(3*4^2-8)-1/(3(3*4^2-8)+2/(9(3*4^2-8)*2

Input:

$$-0.5 + \frac{4}{3\,(3\times 4^2-8)} - \frac{1}{3\,(3\times 4^2-8)} + \frac{2}{9\,(3\times 4^2-8)}\times 2$$

Result:

$-0.463888888888888888888888888888888888888888888888888888...$

Repeating decimal:

$-0.463\overline{8}$ (period 1)

-0.4638

From the three results, we obtain:

(29.75-0.5-0.4638888)^1/7

Input interpretation:

$$\sqrt[7]{29.75 - 0.5 - 0.4638888}$$

Result:

1.6160497043371648999427986475300745797661113313079353491 66...

1.616049704…. result that is a good approximation to the value of the golden ratio 1.618033988749….

Now, we have that:

$$\rho_0\,\rho_2\,\mathcal{B}_T^{(1)}{}_{\nu_1\nu_2} + 4\,\rho_2\,\mathcal{B}_T^{(2)}{}_{(\nu_1;\nu_2)} + 8\,\mathcal{B}_T^{(3)}{}_{\nu_1\nu_2} = \frac{4}{9}\,a_{\nu_1\nu_2}\,,$$
$$\rho_2\,\mathcal{B}_T^{(1)}{}_{\mu\nu} + \frac{1}{2}\,(\rho_2\,\rho_4 + 4)\,\mathcal{B}_T^{(2)}{}_{(\mu;\nu)} + (3\,\rho_3 + 1)\,\mathcal{B}_T^{(3)}{}_{\mu\nu} = -\frac{1}{9}\,a_{\mu\nu}\,, \qquad (2.188)$$
$$4\,\mathcal{B}_T^{(1)}{}_{\mu_1\mu_2} + 2\,(3\,\rho_3 + 1)\,\mathcal{B}_T^{(2)}{}_{(\mu_1;\mu_2)} + (3\,\rho_3^2 + 1)\,\mathcal{B}_T^{(3)}{}_{\mu_1\mu_2} = \frac{2}{9}\,a_{\mu_1\mu_2}\,.$$

$$\mathcal{B}_T^{(1)}{}_{\nu_1\nu_2} = \frac{4}{3\,(3\,D^2-8)}\,a_{\nu_1\nu_2}\,,$$
$$\mathcal{B}_T^{(2)}{}_{(\mu;\nu)} = -\frac{2}{3\,(3\,D^2-8)}\,a_{\mu\nu}\,,$$
$$\mathcal{B}_T^{(3)}{}_{\mu_1\mu_2} = \frac{2}{9\,(3\,D^2-8)}\,a_{\mu_1\mu_2}\,.$$

4/(3(3*16-8))-2/(3(3*16-8))+2/(9(3*16-8))

Input:

$$\frac{4}{3\,(3\times 16-8)} - \frac{2}{3\,(3\times 16-8)} + \frac{2}{9\,(3\times 16-8)}$$

Exact result:

$$\frac{1}{45}$$

Decimal approximation:

0.022222222222222222222222222222222222222222222222222222...

0.02222…

From

$$E_\varphi = \mathcal{E}_\varphi + \frac{4}{3\,(3\,D^2-8)}\,\eta_{(\mu_1\mu_2}\,\eta_{\mu_3\mu_4)}\,a_{\nu_1\nu_2} - \frac{1}{3\,(3\,D^2-8)}\,\eta_{(\nu_1|(\mu_1}\,\eta_{\mu_2\mu_3}\,a_{\mu_4)|\nu_2)}$$
$$+ \frac{2}{9\,(3\,D^2-8)}\,\left(\eta_{\nu_1\nu_2}\,\eta_{(\mu_1\mu_2|} + \eta_{\nu_1\,(\mu_1}\,\eta_{\mu_2|\nu_2}\right)\,a_{|\mu_3\mu_4)} = \mathcal{K}_{\mu_1\ldots\mu_4;\nu_1\nu_2}\,. \qquad (2.205)$$

we obtain:

-0.5+4/(3(3*16-8))-1/(3(3*16-8))+2/(9(3*16-8))*2

Input:

$$-0.5+\frac{4}{3\,(3\times 16-8)}-\frac{1}{3\,(3\times 16-8)}+\frac{2}{9\,(3\times 16-8)}\times 2$$

Result:

$-0.463888888888888888888888888888888888888888888888888888...$

Repeating decimal:

$-0.463\overline{8}$ (period 1)

-0.4638

From

$$\begin{aligned}
\mathcal{B}_T^{(1)}{}_{\nu_1\nu_2} &= \frac{4}{3\,(3D^2-8)}\,a_{\nu_1\nu_2} + C\Big\{(3D^3+24D^2+40D-16)\,j^{(1)}{}_{\nu_1\nu_2} \\
&\quad -8\,(3D^2+12D+4)\,j^{(2)}{}_{\nu_1\nu_2} + 16\,\rho_1\,j^{(3)}{}_{\nu_1\nu_2}\Big\}\,, \\
\mathcal{B}_T^{(2)}{}_{(\mu;\nu)} &= -\frac{2}{3\,(3D^2-8)}\,a_{\mu\nu} + 2\,C\Big\{-(3D^2+12D+4)\,j^{(1)}{}_{\mu\nu} \\
&\quad +(3D^3+12D^2+16D-8)\,j^{(2)}{}_{\mu\nu} - \rho_2\,(3D-2)\,j^{(3)}{}_{\mu\nu}\Big\}\,, \qquad (2.203) \\
\mathcal{B}_T^{(2)}{}_{[\mu;\nu]} &= \frac{1}{\rho_2\rho_4}\,\mathcal{J}'^{\hat{\mu}}{}_{[\mu;\nu]}\,, \\
\mathcal{B}_T^{(3)}{}_{\mu_1\mu_2} &= \frac{2}{9\,(3D^2-8)}\,a_{\mu_1\mu_2} + C\Big\{8\,\rho_1\,j^{(1)}{}_{\mu_1\mu_2} - 4\,\rho_2\,(3D-2)\,j^{(2)}{}_{\mu_1\mu_2} \\
&\quad +\rho_2\,(D^2+2D-4)\,j^{(3)}{}_{\mu_1\mu_2}\Big\}\,,
\end{aligned}$$

we obtain:

$$C = \frac{1}{\rho_0\,\rho_4\,\rho_6\,(3\,D^2-8)}$$

C = 1/(3*16-8) = 1/40

$$\mathcal{B}_T^{(1)}{}_{\nu_1\nu_2} = \frac{4}{3\,(3D^2-8)}\,a_{\nu_1\nu_2} + C\Big\{(3D^3+24D^2+40D-16)\,j^{(1)}{}_{\nu_1\nu_2} - 8\,(3D^2+12D+4)\,j^{(2)}{}_{\nu_1\nu_2} + 16\,\rho_1\,j^{(3)}{}_{\nu_1\nu_2}\Big\}\,,$$

4/(3(3*16*8))+1/40((((3*64+24*16+40*4-16)-8(3*16+12*4+4)+16))))

Input:

$$\frac{4}{3\,(3\times16\times8)} + \frac{1}{40}\,((3\times64+24\times16+40\times4-16)-8\,(3\times16+12\times4+4)+16)$$

Exact result:

$$-\frac{2299}{1440}$$

Decimal approximation:

−1.596527777777777777777777777777777777777777777777777777...

-1.596527

1-1/(((4/(3(3*16*8))+1/40((((3*64+24*16+40*4-16)-8(3*16+12*4+4)+16))))))

Input:

$$1-\frac{1}{\frac{4}{3\,(3\times16\times8)} + \frac{1}{40}\,((3\times64+24\times16+40\times4-16)-8\,(3\times16+12\times4+4)+16)}$$

Exact result:

$$\frac{3739}{2299}$$

Decimal approximation:

1.626359286643679860809047411918225315354501957372770769 89...

1.626359286…. result that is a good approximation to the value of the golden ratio 1.618033988749 and to the value of zeta(2) ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ... and their means. Indeed: (1.644934 + 1.61803398) / 2 = 1.63148399

$$\mathcal{B}^{(2)}_{T\,[\mu;\nu]} - \frac{1}{\rho_2\rho_4}\,\mathcal{J}^{\prime}{}_{\mu}{}^{\hat{\prime}}{}_{[\mu;\nu]}\,,$$

$$\mathcal{B}^{(3)}_{T\,\mu_1\mu_2} = \frac{2}{9\,(3D^2-8)}\,a_{\mu_1\mu_2} + C\Big\{8\,\rho_1\,j^{(1)}{}_{\mu_1\mu_2} - 4\rho_2\,(3D-2)\,j^{(2)}{}_{\mu_1\mu_2} + \rho_2\,(D^2+2D-4)\,j^{(3)}{}_{\mu_1\mu_2}\Big\}\,,$$

2/(9(3*16-8))+1/40((8-4(3*4-2)+(16+8-4)))

Input:

$$\frac{2}{9\,(3\times16-8)} + \frac{1}{40}\,(8-4\,(3\times4-2)+(16+8-4))$$

Exact result:

$$-\frac{53}{180}$$

Decimal approximation:

−0.2944444444444444444444444444444444444444444444444444444...

-0.2944

$$\mathcal{B}^{(2)}_{T\,(\mu;\nu)} = -\frac{2}{3\,(3D^2-8)}\,a_{\mu\nu} + 2C\Big\{-(3D^2+12D+4)\,j^{(1)}{}_{\mu\nu} + (3D^3+12D^2+16D-8)\,j^{(2)}{}_{\mu\nu} - \rho_2\,(3D-2)\,j^{(3)}{}_{\mu\nu}\Big\}\,,$$

-2/(3(3*16-8))+2*1/40(((-(3*16+12*4+4)+(3*64+12*16+16*4-8)-(3*4-2))))

Input:

$$-\frac{2}{3\,(3\times16-8)} + 2\times\frac{1}{40}\,(-(3\times16+12\times4+4)+(3\times64+12\times16+16\times4-8)-(3\times4-2))$$

Exact result:

$$\frac{989}{60}$$

Decimal approximation:

16.483333333333333333333333333333333333333333333333333333333...

Repeating decimal:

$16.48\overline{3}$ (period 1)

16.483

From the three results

16.483; -0.2944; -1.596527

we obtain also:

4*[(16.483 *1/ -0.2944 *1/-1.596527)^2-199-7+(sqrt2)/8]

Input interpretation:

$$4\left(\left(16.483\left(-\frac{1}{0.2944}\right)\left(-\frac{1}{1.596527}\right)\right)^2-199-7+\frac{\sqrt{2}}{8}\right)$$

Result:

4096.02...

4096.02…. ≈ 4096 = 64^2

sqrt(((4*[(16.483 *1/ -0.2944 *1/-1.596527)^2-199-7+(sqrt2)/8])))

Input interpretation:

$$\sqrt{4\left(\left(16.483\left(-\frac{1}{0.2944}\right)\left(-\frac{1}{1.596527}\right)\right)^2-199-7+\frac{\sqrt{2}}{8}\right)}$$

Result:

64.0001...

64.0001… ≈ 64 = 8^2

Now, we have that:

$$\mathcal{L} = \frac{1}{2}\langle\, \varphi\,,\, \mathcal{A} - \frac{1}{2}\eta^{ij}\,\mathcal{A}'_{ij} + \frac{1}{12}\eta^{ij}\,\eta^{kl}\,\mathcal{A}''_{ij\,;\,kl} - \frac{1}{144}\eta^{ij}\,\eta^{kl}\,\eta^{mn}\,\mathcal{A}'''_{ij\,;\,kl\,;\,mn} + \dots \,\rangle$$
$$- \frac{1}{24}\langle\, \alpha_{ijk}\,,\, \partial_{(i}\mathcal{A}'_{jk)} - \frac{1}{4}\eta^{lm}\,\partial_{(i}\mathcal{A}''_{jk)\,;\,lm} + \frac{1}{40}\eta^{lm}\,\eta^{np}\,\partial_{(i}\mathcal{A}'''_{jk)\,;\,lm\,;\,np} + \dots \,\rangle \qquad (3.27)$$
$$+ \frac{1}{8}\langle\, \beta_{ijkl}\,,\, \mathcal{C}_{ijkl}\,\rangle\,,$$

1/2 (1-1/2+1/12-1/144)-1/24(1-1/4+1/40)+1/8

Input:

$$\frac{1}{2}\left(1-\frac{1}{2}+\frac{1}{12}-\frac{1}{144}\right)-\frac{1}{24}\left(1-\frac{1}{4}+\frac{1}{40}\right)+\frac{1}{8}$$

Exact result:

$$\frac{1097}{2880}$$

Decimal approximation:

0.380902777777777777777777777777777777777777777777777777...

0.3809027….

$$\mathcal{L} = \frac{1}{2}\,\varphi^{\{4,2\}\,\mu_1\dots\mu_4\,;\,\nu_1\nu_2}\Big\{\,\mathcal{A}^{\{4,2\}}{}_{\mu_1\dots\mu_4\,;\,\nu_1\nu_2} - \frac{1}{2}\,\eta_{(\mu_1\mu_2}\,\mathcal{A}'^{\mu\,\{2,2\}}{}_{\mu_3\mu_4)\,;\,\nu_1\nu_2}$$
$$- \frac{1}{2}\,\eta_{(\mu_1\mu_2}\,\mathcal{A}'^{\mu\,\{3,1\}}{}_{\mu_3\mu_4)\,;\,\nu_1\nu_2} + \frac{1}{4}\,\eta_{(\nu_1|(\mu_1}\,\mathcal{A}'^{\mu\,\{3,1\}}{}_{\mu_2\mu_3\,;\,\mu_4)\,|\,\nu_2)}$$
$$- \frac{1}{2}\,\eta_{(\mu_1\mu_2}\,\mathcal{A}'^{\mu\,\{4\}}{}_{\mu_3\mu_4)\,\nu_1\nu_2} + \frac{3}{4}\,\eta_{(\nu_1|(\mu_1}\,\mathcal{A}'^{\mu\,\{4\}}{}_{\mu_2\mu_3\mu_4)\,|\,\nu_2)} - 3\,\eta_{\nu_1\nu_2}\,\mathcal{A}'^{\mu\,\{4\}}{}_{\mu_1\dots\mu_4}$$
$$+ \frac{1}{18}\left(2\,\eta_{\nu_1\nu_2}\,\eta_{(\mu_1\mu_2|} - \eta_{\nu_1\,(\mu_1}\eta_{\mu_2\,|\,\nu_2)}\right)\left(\mathcal{A}'^{\mu'\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\,\mu_3\mu_4)}\Big\} \qquad (4.13)$$
$$- 4\,\alpha^{(1)\{2,1\}\,\mu\,;\,\nu_1\nu_2}\,\partial^{\lambda}\Big\{\,\mathcal{A}'^{\mu\,\{2,1\}}{}_{\lambda\mu\,;\,\nu_1\nu_2} - \frac{1}{18}\,Y_{\{2,1\}}\,\eta_{\nu_1\nu_2}\left(\mathcal{A}'^{\mu'\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{\mu\lambda}\Big\}$$
$$- 10\,\alpha^{(1)\{3\}\,\mu_1\mu_2\mu_3}\,\partial^{\lambda}\Big\{\,\mathcal{A}'^{\mu\,\{3\}}{}_{\lambda\mu_1\,;\,\mu_2\mu_3} - \frac{1}{18}\,\eta_{(\mu_1\mu_2}\left(\mathcal{A}'^{\mu'\nu} - \mathcal{A}^{\hat{\imath}\hat{\imath}}\right)_{|\,\mu_3)\,\lambda}\Big\}$$
$$+ 3\,\widetilde{\beta}^{\nu_1\nu_2}\,\mathcal{C}^{(1)}{}_{\nu_1\nu_2}\,.$$

1/2 [((1-1/2-1/2+1/4-1/2+3/4-3+1/18(2-1)(1-1)))]-4[1-1/18(1-1)]-10[1-1/18(1-1)]+3

Input:

$$\frac{1}{2}\left(1-\frac{1}{2}-\frac{1}{2}+\frac{1}{4}-\frac{1}{2}+\frac{3}{4}-3+\frac{1}{18}(2-1)(1-1)\right)-$$
$$4\left(1-\frac{1}{18}(1-1)\right)-10\left(1-\frac{1}{18}(1-1)\right)+3$$

Exact result:

$$-\frac{49}{4}$$

Decimal form:

−12.25

-12.25

From the difference of the two results, we obtain:

-(-12.25-0.3809027)

Input interpretation:

$-(-12.25-0.3809027)$

Result:

12.6309027

12.6309027 ≈ 4π and very near to the black hole entropy 12.5664

From the sum, instead, we obtain:

-(-12.25+0.3809027)

Input interpretation:

$-(-12.25+0.3809027)$

Result:

11.8690973

11.8690973 result very near to the black hole entropy 11.8458

[-(-12.25+0.3809027)]^3+55+2

Input interpretation:

$(-(-12.25+0.3809027))^3+55+2$

Result:

1729.064669121798616197317

1729.0646….

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)

((([-(-12.25+0.3809027)]^3+55+2)))^1/15

Input interpretation:

$\sqrt[15]{(-(-12.25+0.3809027))^3+55+2}$

Result:

1.643819...

1.643819…. $\approx \zeta(2) = \frac{\pi^2}{6} = 1.644934$ ...

[-(-12.25+0.3809027)]^2-3/2

Input interpretation:

$(-(-12.25+0.3809027))^2 - \frac{3}{2}$

Result:

139.37547071686729

139.37547… result practically equal to the rest mass of Pion meson 139.57 MeV

[-(-12.25+0.3809027)]^2-3/2-11-3

Input interpretation:

$$(-(-12.25+0.3809027))^2-\frac{3}{2}-11-3$$

Result:

125.37547071686729

125.37547… result very near to the Higgs boson mass 125.18 GeV

1+1/((([-(-12.25+0.3809027)]^1/5)))

Input interpretation:

$$1+\frac{1}{\sqrt[5]{-(-12.25+0.3809027)}}$$

Result:

1.609700...

1.6097…. result that is a good approximation to the value of the golden ratio 1.618033988749...

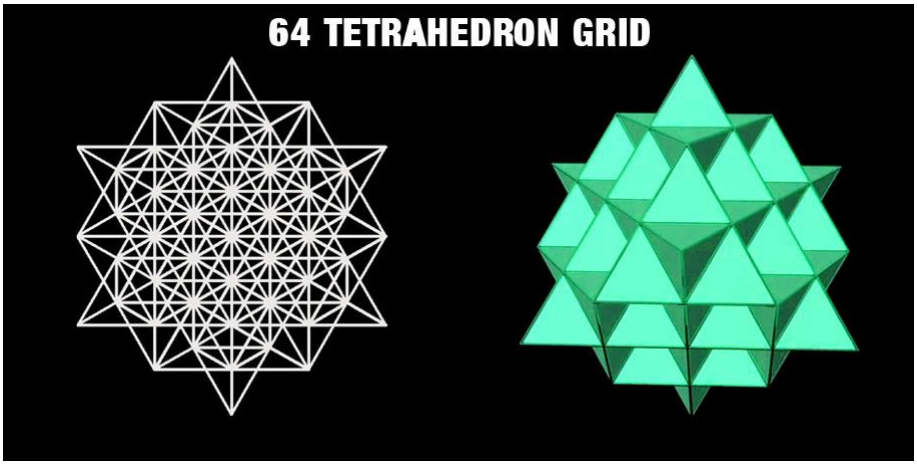
From

“String Theory, Gravity and Particle Physics” – Augusto Sagnotti – Scuola Normale Superiore & INFN, Pisa – AstronomiAmo 23-4-2020

The geometric bases of String Theory are not yet known and its equations are only "approximations", although mathematically they are coherent to unify gravity with other fundamental forces.



The geometry of spacetime could also have a tetrahedral matrix that forms infinite scalar octaves of cuboctahedra: a perfectly balanced geometric structure. A grid of 64 tetrahedrons is needed, with 64 being the least number of tetrahedrons needed, to start seeing a fractal pattern of two octaves of cubottahedra beginning to form. Among other things, the tetrahedron is a platonic solid and the cuboctahedron an archimedean solid



https://www.pinterest.it/pin/525865693963283548/

The number 64, is a fundamental number for the construction of a possible TOE (Theory of Everything). We, in the our researches, indeed, consider and obtain the number 8 and the multiples of it, fundamental for a mathematical unification of the several sectors of Physics and Cosmology. For example, in the group SO(8192) open bosonic string theory in 26 dimensions, we have that: $64^2 * 2 = 4096 * 2 = 8192$ and $\sqrt{4096} = 64$.

In conclusion, we note that in the fundamental Ramanujan paper “Modular Equations and Approximations to π”, the numbers 64 and 4096 are very important in the development of a chapter of this work.

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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