On some Ramanujan formulas: mathematical connections with various equations concerning some sectors of Particle Physics and Black Hole Physics.

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Abstract

The purpose of this paper is to show how using certain mathematical values and / or constants from various Ramanujan expressions, we obtain some mathematical connections with the equations of various sectors of Particle Physics and Black Hole Physics

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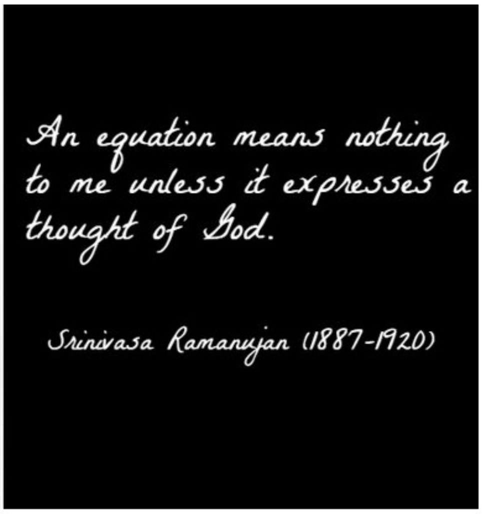


(N.O.A – Pics. from the web)

From:

On long range axion hairs for black holes
Francesco Filippini, Gianmassimo Tasinato - Department of Physics, Swansea University, Swansea, SA2 8PP, UK - arXiv:1903.02950v1 [gr-qc] 7 Mar 2019

We have that:

$$r_{\pm} = M \pm \sqrt{M^2 - P^2 - Q^2}\,. \qquad (8)$$

We take the data of SMBH87 Black Hole

Q = 6.19631e+26,   M = 13.12806e+39, r = 1.94973e+13 we obtain:

(1.94973e+13)^2 = (13.12806e+39)^2 + (((sqrt((((13.12806e+39)^2-x^2-(6.19631e+26)^2))))))^2

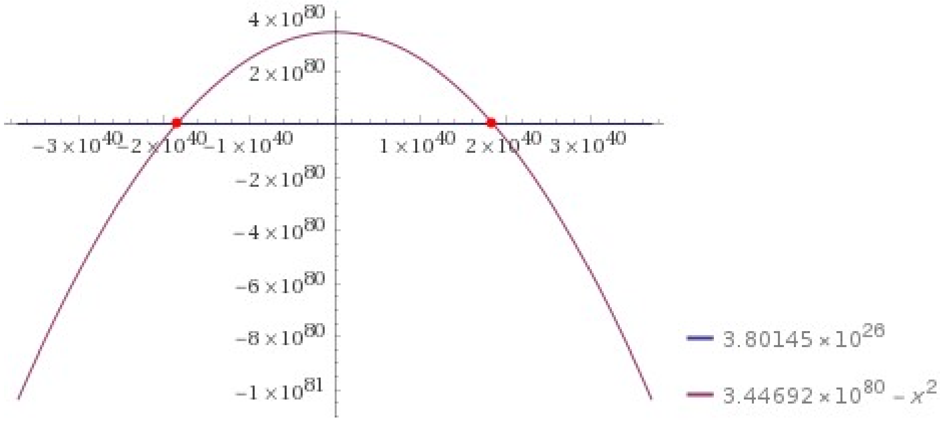
Input interpretation:

$$(1.94973\times10^{13})^2 = (13.12806\times10^{39})^2 + \sqrt{(13.12806\times10^{39})^2 - x^2 - (6.19631\times10^{26})^2}^{\,2}$$

Result:

$$3.80145\times10^{26} = 3.44692\times10^{80} - x^2$$

Plot:



Alternate forms:

$$x^2 - 3.44692\times10^{80} = 0$$

$$3.80145\times10^{26} = -(x - 1.85659\times10^{40})(x + 1.85659\times10^{40})$$

Solutions:

$x = -18\,565\,880\,499\,647\,733\,855\,903\,511\,291\,405\,086\,490\,624$

$x = 18\,565\,880\,499\,647\,733\,855\,903\,511\,291\,405\,086\,490\,624$

Integer solution:

$x = \pm18\,565\,880\,499\,647\,733\,855\,903\,511\,291\,405\,086\,490\,624$

sqrt((((((((((((13.12806e+39)^2 + sqrt((((13.12806e+39)^2-(1.85658804996477e+40)^2-(6.19631e+26)^2))))))))))))

Input interpretation:

$$\sqrt{\left((13.12806\times 10^{39})^2 + \sqrt{(13.12806\times 10^{39})^2-(1.85658804996477\times 10^{40})^2-(6.19631\times 10^{26})^2}\right)}$$

Result:

$1.31281... \times 10^{40} +$
$0.500000...\, i$

Alternate form:

1.31281×10^{40}

$1.31281*10^{40} = 13.1281 * 10^{39}$ (SMBH87 mass)

Thence:

P = 1.85658804996477e+40 and Q = 6.19631e+26, M = 13.12806e+39,
r = 1.94973e+13

From

$$\omega_{ISCO} = +\frac{1}{6\sqrt{6}M} + \frac{7\left(P^2+Q^2\right)^2}{144\sqrt{6}M^3} + \frac{49\left(P^2+Q^2\right)^4}{2304\sqrt{6}M^5} + \frac{5489\left(P^2+Q^2\right)^6}{497664\sqrt{6}M^7} + g_F^2 P^2 Q^2\left[-\frac{1}{216\sqrt{6}M^5} + \left(P^2+Q^2\right)^2\left(\frac{11\lambda}{699840\sqrt{6}M^9} - \frac{47}{7776\sqrt{6}M^7}\right)\right]. \quad (37)$$

We obtain:

1/((6sqrt6)*13.12806e+39) + 7((((((1.856588e+40)^2+(6.19631e+26)^2)))))^2 / (144sqrt6*(13.12806e+39)^3) + 49((((((1.856588e+40)^2+(6.19631e+26)^2)))))^4 / (2304sqrt6*(13.12806e+39)^5)

Input interpretation:

$$\frac{1}{\left(6\sqrt{6}\right)\times 13.12806\times 10^{39}}+7\times\frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^2}{144\sqrt{6}\,(13.12806\times 10^{39})^3}+49\times\frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^4}{2304\sqrt{6}\,(13.12806\times 10^{39})^5}$$

Result:

$3.1431096212770355634677624444987817837260326747426399... \times 10^{119}$

$3.143109621277*10^{119}$

489((((((1.856588e+40)^2+(6.19631e+26)^2)))))^6 / (497664sqrt6*(13.12806e+39)^7)

Input interpretation:

$$5489\times\frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7}$$

Result:

$1.1237351821977805486778059630011930376732930061102854... \times 10^{200}$

$1.12373518219778*10^{200}$

5^2((1.856588e+40)^2*(6.19631e+26)^2)*(((((((-1/((216sqrt6)*(13.12806e+39)^5)+((((((1.856588e+40)^2+(6.19631e+26)^2)))))^2*(11*3/(699840sqrt6*(13.12806e+39)^9)-47/(7776sqrt6*(13.12806e+39)^7)))))))))

Input interpretation:

$$5^2\left((1.856588\times 10^{40})^2\left(6.19631\times 10^{26}\right)^2\right)\left(-\frac{1}{\left(216\sqrt{6}\right)(13.12806\times 10^{39})^5}+\left((1.856588\times 10^{40})^2+\left(6.19631\times 10^{26}\right)^2\right)^2\left(11\times\frac{3}{699840\sqrt{6}\,(13.12806\times 10^{39})^9}-\frac{47}{7776\sqrt{6}\,(13.12806\times 10^{39})^7}\right)\right)$$

Result:

$-1.44332... \times 10^{13}$

$-1.44332...*10^{13}$

3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13

Input interpretation:

$$3.143109621277\times 10^{119} + 5489\times\frac{((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7} - 1.44332\times 10^{13}$$

Result:

$1.1237351821977805486778059630011930376732930061102854... \times 10^{200}$

$1.1237351821...*10^{200}$

(((((3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13)))))^((((7 (π^2 - 1))/(2 π))/9460.30))

where 9460.30 is the rest mass of Upsilon meson

Input interpretation:

$$\left(3.143109621277\times 10^{119} + 5489\times\frac{((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7} - 1.44332\times 10^{13}\right)^{\frac{7(\pi^2-1)}{2\pi}/9460.30}$$

Result:

1.617920887312614072882124789538807770347384320221727659467...

1.6179208873126... result that is a very good approximation to the value of the golden ratio 1,618033988749...

From which:

(((((3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13)))))^((((7 (x^2 - 1))/(2 π))/9460.30)) = 1.6179208873126

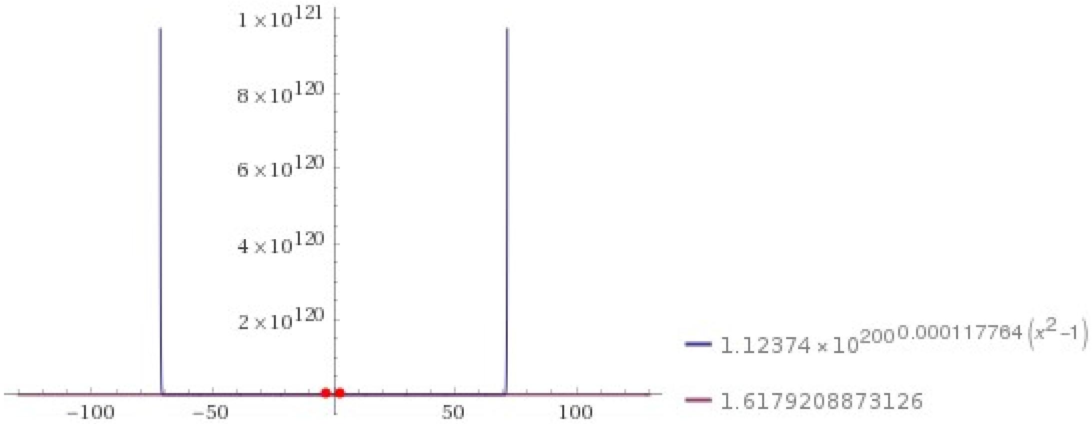
Input interpretation:

$$\left(3.143109621277\times 10^{119}+5489\times\frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7}-1.44332\times 10^{13}\right)^{\frac{7(x^2-1)}{2\pi}/9460.30}=1.6179208873126$$

Result:

$$1.12374\times 10^{200^{0.000117764\,(x^2-1)}}=1.6179208873126$$

Plot:



Alternate forms:

$$1.12374\times 10^{200^{0.000117764\,x^2}}=1.70811$$

$$0.947199\,e^{0.0542462\,x^2}=1.6179208873126$$

$$0.947199\times 1.12374\times 10^{200^{0.000117764\,x^2}}=1.6179208873126$$

Alternate form assuming x is positive:

$$e^{0.0542462\,x^2}=1.70811$$

Alternate form assuming x is real:

$$1.123735182197780\times 10^{200^{0.000117764\,(x^2-1)}}+0=1.6179208873126$$

Real solutions:

$x \approx -3.14159$

$x \approx 3.14159$

3.14159 = π

Solutions:

$x \approx -4.29354 \sqrt{(6.28319 i) n + 0.535388}\,, \quad n \in \mathbb{Z}$

$x \approx 4.29354 \sqrt{(6.28319 i) n + 0.535388}\,, \quad n \in \mathbb{Z}$

$\mathbb{Z}$ is the set of integers

Furthermore, we have:

1/[(((((3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13)))))^((((7 (π^2 - 1))/(2 π))/9460.30))]

Input interpretation:

$$1 \Big/ \left(3.143109621277 \times 10^{119} + 5489 \times \frac{\left((1.856588 \times 10^{40})^2 + (6.19631 \times 10^{26})^2\right)^6}{497664 \sqrt{6}\, (13.12806 \times 10^{39})^7} - 1.44332 \times 10^{13}\right)^{\frac{7(\pi^2-1)}{2\pi} / 9460.30}$$

Result:

0.618077192674736988819404916236307820493629784906386363749...

0.6180771926747… result that is a very good approximation to the value of the golden ratio conjugate 0,618033988749...

27*8/[(((((3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13)))))^((((7 (π^2 - 1))/(2 π))/9460.30))]+7-1

Input interpretation:

$$27\times 8\left/\left(3.143109621277\times 10^{119}+5489\times \frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7}-1.44332\times 10^{13}\right)^{\frac{7(\pi^2-1)}{2\pi}/9460.30}\right.+7-1$$

Result:

139.505...

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

27*8/[(((((3.143109621277e+119 + 5489((((1.856588e+40)^2+(6.19631e+26)^2)))^6 / (497664sqrt6*(13.12806e+39)^7)– 1.44332e+13)))))^((((7 (π^2 - 1))/(2 π))/9460.30))]-8

Input interpretation:

$$27\times 8\left/\left(3.143109621277\times 10^{119}+5489\times \frac{\left((1.856588\times 10^{40})^2+(6.19631\times 10^{26})^2\right)^6}{497664\sqrt{6}\,(13.12806\times 10^{39})^7}-1.44332\times 10^{13}\right)^{\frac{7(\pi^2-1)}{2\pi}/9460.30}\right.-8$$

Result:

125.505...

125.505… result 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

From:

We can solve the previous condition analitically by expanding for small values of magnetic and electric charges P and Q. We push our perturbative expansion up to order $\mathcal{O}(\text{charge}^6)$ for catching the effects of the Chern-Simons coupling g_F, and non-minimal couplings with gravity λ. In these approximations, the ISCO radius results

$$\begin{aligned} r_{ISCO} &= 6M - \frac{(P^2+Q^2)}{2M} - \frac{19\,(P^2+Q^2)^2}{72M^3} - \frac{5\,(P^2+Q^2)^3}{48M^5} \\ &+ g_F^2 P^2 Q^2 \left[\frac{19}{144} + (P^2+Q^2)\,\frac{(49410M^2-193\lambda)}{466560M^7}\right]. \end{aligned} \tag{36}$$

The first line contains the General Relativity expression for the ISCO radius: the Schwarzschild result ($6M$) and the first corrections in small values of the charges associated with a dyonic Reissner-Nördstrom configuration. The second line contains instead the contributions associated with the presence of black hole axion hair, the Chern-Simons terms, and non-minimal coupling with gravity. For small values of the charges, these contributions start only at order $\mathcal{O}(\text{charge}^4)$, hence it can be difficult to use the properties of ISCO to reveal the existence of axion hairs. To conclude, we report

$$\begin{aligned} r_{ISCO} &= 6M - \frac{(P^2+Q^2)}{2M} - \frac{19\,(P^2+Q^2)^2}{72M^3} - \frac{5\,(P^2+Q^2)^3}{48M^5} \\ &+ g_F^2 P^2 Q^2 \left[\frac{19}{144} + (P^2+Q^2)\,\frac{(49410M^2-193\lambda)}{466560M^7}\right]. \end{aligned}$$

(6*13.12806e+39)- ((((((1.856588e+40)^2+(6.19631e+26)^2)))))/(2*13.12806e+39)-(((((19(((1.856588e+40)^2+(6.19631e+26)^2)))^2))/(72*(13.12806e+39)^3)-(((((5(((1.856588e+40)^2+(6.19631e+26)^2)))^3))/(48*(13.12806e+39)^5)

(6*13.12806e+39)- ((((((1.856588e+40)^2+(6.19631e+26)^2)))))/(2*13.12806e+39)-19((((((1.856588e+40)^2+(6.19631e+26)^2)))))^2 /(72*(13.12806e+39)^3)

Input interpretation:

$$6\times 13.12806\times 10^{39} - \frac{(1.856588\times 10^{40})^2 + (6.19631\times 10^{26})^2}{2\times 13.12806\times 10^{39}} - 19\times\frac{((1.856588\times 10^{40})^2 + (6.19631\times 10^{26})^2)^2}{72\,(13.12806\times 10^{39})^3}$$

Result:

$5.1782905531671136792241794999452957667179985696556074\ldots\times 10^{40}$

$5.17829055316711367 9*10^{40}$

((-5(((((1.856588e+40)^2+((((6.19631e+26)^2)))))))^3))/(48*(13.12806e+39)^5)

Input interpretation:

$$\frac{-5\left(\left(1.856588\times 10^{40}\right)^2+\left(6.19631\times 10^{26}\right)^2\right)^3}{48\left(13.12806\times 10^{39}\right)^5}$$

Result:

$-1.0940048233478613613834443196764736247057271213621 38... \times 10^{40}$

$-1.09400482334786136*10^{40}$

5.178290553167113679*10^40 -1.09400482334786136*10^40

Input interpretation:

$5.178290553167113679\times 10^{40} - 1.09400482334786136\times 10^{40}$

Result:

40 842 857 298 192 523 190 000 000 000 000 000 000 000

Scientific notation:

$4.08428572981925231 9\times 10^{40}$

$4.084285729819252319*10^{40}$

5^2((1.856588e+40)^2*(6.19631e+26)^2)*(((((((19/144)+((((((1.856588e+40)^2+(6.19631e+26)^2)))))*(((49410(13.12806e+39)^2)-193*3))/(466560*(13.12806e+39)^7)))))))

Input interpretation:

$$5^2\left(\left(1.856588\times 10^{40}\right)^2\left(6.19631\times 10^{26}\right)^2\right)\left(\frac{19}{144}+\left(\left(1.856588\times 10^{40}\right)^2+\left(6.19631\times 10^{26}\right)^2\right)\times\frac{49410\left(13.12806\times 10^{39}\right)^2-193\times 3}{466560\left(13.12806\times 10^{39}\right)^7}\right)$$

Result:

$4.36544449055728861539425277777777777777777777777777... \times 10^{134}$

4.36544449055...*10^{134}

(4.084285729819252319e+40)+5^2((1.856588e+40)^2*(6.19631e+26)^2)*(((((((19/144)+((((((1.856588e+40)^2+(6.19631e+26)^2)))))*(((49410(13.12806e+39)^2)-193*3))/(466560*(13.12806e+39)^7)))))))

Input interpretation:

$$4.084285729819252319 \times 10^{40} + 5^2 \left((1.856588 \times 10^{40})^2 \left(6.19631 \times 10^{26}\right)^2\right)\left(\frac{19}{144} + \left((1.856588 \times 10^{40})^2 + \left(6.19631 \times 10^{26}\right)^2\right) \times \frac{49410\,(13.12806 \times 10^{39})^2 - 193 \times 3}{466560\,(13.12806 \times 10^{39})^7}\right)$$

Result:

$4.36544449055728861539425277777777777777777777777777... \times 10^{134}$

4.36544449055...*10^{134}

(4.365444490557288615394252777777777×10^134)^1/64-golden ratio

Input interpretation:

$$\sqrt[64]{4.365444490557288615394252777777777 \times 10^{134}} - \phi$$

ϕ is the golden ratio

Result:

125.366387524683820029042039967533320...

125.366387524… result 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

Alternative representations:

$$\sqrt[64]{4.3654444905572886153942527777777770000 \times 10^{134}} - \phi = \sqrt[64]{4.3654444905572886153942527777777770000 \times 10^{134}} - 2\sin(54°)$$

$$\sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} - \phi = 2\cos(216°) + \sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}}$$

$$\sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} - \phi = \sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} + 2\sin(666°)$$

(4.365444490557288615394252777777777×10^134)^1/64+11+golden ratio

Input interpretation:

$$\sqrt[64]{4.365444490557288615394252777777777 \times 10^{134}} + 11 + \phi$$

ϕ is the golden ratio

Result:

139.602455502183609725451213636264448...

139.6024555021… result practically equal to the rest mass of Pion meson 139.57 MeV

Alternative representations:

$$\sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} + 11 + \phi = 11 + \sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} + 2\sin(54°)$$

$$\sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} + 11 + \phi = 11 - 2\cos(216°) + \sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}}$$

$$\sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} + 11 + \phi = 11 + \sqrt[64]{4.365444490557288615394252777777770000 \times 10^{134}} - 2\sin(666°)$$

(4.365444490557288615394252777777777×10^134)^((log(((1197-29)/(1197-29-7))))/log(48))

where 1197 is practically equal to the rest mass of the sigma baryon 1197.449

Input interpretation:

$$(4.3654444905572886153942527777777\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)}$$

$\log(x)$ is the natural logarithm

Result:

1.61833477743496254173250121191768379...

1.6183347774349… result that is a very good approximation to the value of the golden ratio 1,618033988749...

Alternative representations:

$$(4.36544449055728861539425277777777770000\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)} = (4.36544449055728861539425277777777770000\times 10^{134})^{\log_e\left(\frac{1168}{1161}\right)/\log_e(48)}$$

$$(4.36544449055728861539425277777777770000\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)} = (4.36544449055728861539425277777777770000\times 10^{134})^{\left(\log(a)\log_a\left(\frac{1168}{1161}\right)\right)/(\log(a)\log_a(48))}$$

$$(4.36544449055728861539425277777777770000\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)} = (4.36544449055728861539425277777777770000\times 10^{134})^{\left(-\text{Li}_1\left(1-\frac{1168}{1161}\right)\right)/(-\text{Li}_1(-47))}$$

Integral representations:

$$(4.36544449055728861539425277777777770000\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)} = 4.36544449055728861539425277777777770000\times 10^{134\left(\int_1^{\frac{1168}{1161}}\frac{1}{t}\,dt\right)/\left(\int_1^{48}\frac{1}{t}\,dt\right)}$$

$$(4.36544449055728861539425277777777770000\times 10^{134})^{\log\left(\frac{1197-29}{1197-29-7}\right)/\log(48)} = 4.36544449055728861539425277777777770000\times 10^{134\left(\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{\left(\frac{1161}{7}\right)^s\Gamma(-s)^2\Gamma(1+s)}{\Gamma(1-s)}\,ds\right)/\left(\int_{-i\infty+\gamma}^{i\infty+\gamma}\frac{47^{-s}\Gamma(-s)^2\Gamma(1+s)}{\Gamma(1-s)}\,ds\right)} \quad \text{for } -1<\gamma<0$$

From:

Superradiant instabilities of rotating black branes and strings
Vitor Cardoso, and Shijun Yoshida - arXiv:hep-th/0502206v2 4 Jul 2005

We have that:

The effective potential V is equal to

$$-V = \frac{1}{r^2}(-\lambda - a^2\mu^2 - \frac{n}{2} - \frac{n^2}{4} - 2am\omega + 2a^2\omega^2) + \frac{a^2}{r^4}(a^2\omega^2 - 2am\omega - \frac{n^2}{2} - jn + m^2 - \lambda - j^2 + j + 2) + \frac{a^4}{r^6}(2 + j - j^2 + \frac{n}{2} - nj - \frac{n^2}{4}) + \frac{\mu^2 M}{r^{n+1}} + \frac{M}{r^{n+3}}(\lambda - 1 - \frac{n}{2}) + \frac{M^2}{r^{n+4}}(1 + n + \frac{n^2}{4}) + \frac{Ma^2}{r^{n+5}}(j^2 - j - 3 + jn + \frac{3n}{2}) + \omega^2 - \mu^2 . \quad (2.10)$$

2.2.2 The potential well

The effective potential in four dimensions, d = 4, as given by (2.10) is plotted in figure 1, for $a \sim 0.5$ (in units of M), $\mu = 0.7$ and $\omega = 0.6878$. As can be seen from Figure 1 the potential has, in the four-dimensional situation, two extremum between the event horizon and spatial infinity. The local minimum creates a "well"-like structure, which will be so important to trigger the instability. The potential is asymptotic to $(\mu^2 - \omega^2)$ at spatial infinity. That a well must necessarily arise in four dimensions can be seen from the asymptotic nature of the potential. In fact, for $n = 0$ and for large r, the potential in (2.10) behaves as

$$V \sim \mu^2 - \omega^2 - \mu^2 M r^{-1} \ , r \to \infty \ , n = 0 . \quad (2.18)$$

Thence, from

$$V \sim \mu^2 - \omega^2 - \mu^2 M r^{-1} \ , r \to \infty \ , n = 0 .$$

$$V' \sim \frac{\mu^2 M}{r^2}$$

For M = 13.12806e+39, r = 1.94973e+13 , μ = 0.7
and ω = 0.6878 , we obtain:

0.7^2-0.6878^2-(0.7^2*13.12806e+39*(1/(1.94973e+13)))

Input interpretation:

$$0.7^2 - 0.6878^2 - 0.7^2 \times 13.12806 \times 10^{39} \times \frac{1}{1.94973 \times 10^{13}}$$

Result:

$-3.2993026726777553815143635270883086858857380252650\ldots \times 10^{26}$

-3.29930267267...*10^{26}

And:

(0.7^2)*(13.12806e+39) / (1.94973e+13)^2

Input interpretation:

$$0.7^2 \times \frac{13.12806 \times 10^{39}}{(1.94973 \times 10^{13})^2}$$

Result:

$1.6921843910068344752936886272753767372332261519620853\ldots \times 10^{13}$

1.6921843910068...*10^{13}

We note that, from the following Ramanujan mock theta function:

((((((1+(0.449329)/(1-0.449329+0.449329^2) + (0.449329)^4 / ((1-0.449329+0.449329^2) (1-0.449329^2+0.449329^4)))

Input interpretation:

$$1 + \frac{0.449329}{1 - 0.449329 + 0.449329^2} + \frac{0.449329^4}{(1 - 0.449329 + 0.449329^2)(1 - 0.449329^2 + 0.449329^4)}$$

Result:

1.661629733061660233431511733116499148361110514186936135398...

$\chi(q)$ = 1.66162973306…

From which:

Input interpretation:

$$\left(1 + \frac{0.449329}{1 - 0.449329 + 0.449329^2} + \frac{0.449329^4}{(1 - 0.449329 + 0.449329^2)(1 - 0.449329^2 + 0.449329^4)}\right) \times 10^{13}$$

Result:

1.661629733061660233431511733116499148361110514186936 1... × 10^{13}

1.66162973306...*10^{13} result that is very near to the value 1.6921843910068...*10^{13}

Furthermore:

(-(-3.2993026726777553815 1 × 10^26)/(1.6921843910068344752 9 × 10^13))

Input interpretation:

$$-\frac{-3.2993026726777553815 1\times 10^{26}}{1.6921843910068344752 9\times 10^{13}}$$

Result:

1.949730000000000000001671389959055931822872415398747 5... × 10^{13}

1.94973...*10^{13} (SMBH87 radius)

From:

Mock ϑ-functions (of 5th order).

$$f(q)=1+\frac{q}{1+q}+\frac{q^4}{(1+q)(1+q^2)}+\ldots,$$

$$\phi(q)=1+q(1+q)+q^4(1+q)(1+q^3)+q^9(1+q)(1+q^3)(1+q^5)+\ldots,$$

$$\psi(q)=q+q^3(1+q)+q^6(1+q)(1+q^2)+q^{10}(1+q)(1+q^2)(1+q^3)+\ldots,$$

$$\chi(q)=1+\frac{q}{1-q^2}+\frac{q^2}{(1-q^3)(1-q^4)}+\frac{q^3}{(1-q^4)(1-q^5)(1-q^6)}+\ldots$$

$$=1+\frac{q}{1-q}+\frac{q^3}{(1-q^2)(1-q^3)}+\frac{q^5}{(1-q^3)(1-q^4)(1-q^5)}+\ldots,$$

We note that, from the following Ramanujan mock theta function:

1+0.449329/(1-0.449329)+0.449329^3/(((1-0.449329^2)(1-0.449329^3)))+0.449329^5/((((1-0.449329^3)(1-0.449329^4)(1-0.449329^5))))

Input interpretation:

$$1+\frac{0.449329}{1-0.449329}+\frac{0.449329^3}{(1-0.449329^2)(1-0.449329^3)}+\frac{0.449329^5}{(1-0.449329^3)(1-0.449329^4)(1-0.449329^5)}$$

Result:

1.962364415117198543991731184847433294469809298752498955194...

$\chi(q)$ **= 1.962364415...**

From which:

Input interpretation:

$$\left(1+\frac{0.449329}{1-0.449329}+\frac{0.449329^3}{(1-0.449329^2)(1-0.449329^3)}+\frac{0.449329^5}{(1-0.449329^3)(1-0.449329^4)(1-0.449329^5)}\right)\times 10^{13}$$

Result:

$1.9623644151171985439917311848474332944698092987524989... \times 10^{13}$

$1.962364415117...*10^{13}$ a result very near to the value $1.94973...*10^{13}$

We have also that:

((-(0.7^2-0.6878^2-(0.7^2*13.12806e+39*(1/(1.94973e+13)))))))^1/128

Input interpretation:

$$\sqrt[128]{-\left(0.7^2-0.6878^2-0.7^2\times 13.12806\times 10^{39}\times \frac{1}{1.94973\times 10^{13}}\right)}$$

Result:

1.611295421752001417257792081749628579469463857753983226780...

1.611295421752… result that is near to the value of the golden ratio 1,618033988749...

log base 1.611295421752((-(0.7^2-0.6878^2-(0.7^2*13.12806e+39*(1/(1.94973e+13))))))-Pi+1/golden ratio

Input interpretation:

$$\log_{1.611295421752}\left(-\left(0.7^2 - 0.6878^2 - 0.7^2 \times 13.12806 \times 10^{39} \times \frac{1}{1.94973 \times 10^{13}}\right)\right) - \pi + \frac{1}{\phi}$$

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

ϕ is the golden ratio

Result:

125.4764...

125.4764... result 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

log base 1.611295421752((-(0.7^2-0.6878^2-(0.7^2*13.12806e+39*(1/(1.94973e+13))))))+11+1/golden ratio

Input interpretation:

$$\log_{1.611295421752}\left(-\left(0.7^2 - 0.6878^2 - 0.7^2 \times 13.12806 \times 10^{39} \times \frac{1}{1.94973 \times 10^{13}}\right)\right) + 11 + \frac{1}{\phi}$$

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

ϕ is the golden ratio

Result:

139.6180...

139.6180... result practically equal to the rest mass of Pion meson 139.57 MeV

We have that:

(ii) The instability occurs only for $\omega < \mu$. Otherwise, the waves would not be trapped in the potential well, but they would rather escape to infinity, and the perturbation would be damped.

Detweiler [8] finds (in four dimensions), in the limit of small μ, that the characteristic frequencies of the unstable modes are, in our units,

$$\omega \sim \mu + \mathrm{i}\mu \frac{a}{M} \frac{(\mu M)^8}{3072}\,. \tag{2.32}$$

Our numerical results fit this prediction very well. For near-extremal black holes, and $\mu \sim 0.1$ Detweiler's formula (2.32) predicts $\omega \sim 0.1 + 10^{-13}\mathrm{i}$, which checks very well with our numerics (see Figure 2 and 3).

Although of no direct interest for this work, we found also stable modes. Our results for stable modes will be published elsewhere [23], and compared with the existing analytical ones [24].

From

$$\omega \sim \mu + i\mu \frac{a}{M} \frac{(\mu M)^8}{3072}$$

for $l = m = 1$, $\mu = 0.9$ and $a = 0.497$.

0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)

Input interpretation:

$$0.9 + \frac{i \times 0.9 \times 0.497}{13.12806 \times 10^{39}} \times \frac{(0.9 \times 13.12806 \times 10^{39})^8}{3072}$$

i is the imaginary unit

Result:

$0.9 +$
$4.21232... \times 10^{276}\, i$

Polar coordinates:

$r = 4.21232 \times 10^{276}$ (radius), $\theta = 90°$ (angle)

$4.21232*10^{276}$

(((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072))))^1/(1321.71+2)

where 1321.71 is the rest mass of Xi baryon and 2 is the Graviton spin

Input interpretation:

$$\sqrt[1321.71+2]{0.9 + \frac{i \times 0.9 \times 0.497}{13.12806 \times 10^{39}} \times \frac{(0.9 \times 13.12806 \times 10^{39})^8}{3072}}$$

i is the imaginary unit

Result:

$1.61799... +$
$0.00192001...\, i$

Polar coordinates:

$r = 1.61799$ (radius), $\theta = 0.0679907°$ (angle)

1.61799 result that is a very good approximation to the value of the golden ratio 1,618033988749...

and:

1/(((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072))))^1/(1321.71+2)))

Input interpretation:

$$\frac{1}{\sqrt[1321.71+2]{0.9 + \frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}}}$$

i is the imaginary unit

Result:

0.618049... −
0.000733416... i

Polar coordinates:

$r = 0.61805$ (radius), $\theta = -0.0679907°$ (angle)

0.61805 result that is a very good approximation to the value of the golden ratio conjugate 0,618033988749...

((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)))))^1/128-18-golden ratio

Input interpretation:

$$\sqrt[128]{0.9 + \frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}} - 18 - \phi$$

i is the imaginary unit

ϕ is the golden ratio

Result:

125.2913... +
1.778394... i

Polar coordinates:

$r = 125.304$ (radius), $\theta = 0.813206°$ (angle)

125.304 result 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

((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)))))^1/128-7+golden ratio

Input interpretation:

$$\sqrt[128]{0.9+\frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}}-7+\phi$$

i is the imaginary unit

ϕ is the golden ratio

Result:

139.5274... +
1.778394... i

Polar coordinates:

$r = 139.539$ (radius), $\theta = 0.730244°$ (angle)

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

27*1/2(((((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)))))^1/128-18+golden ratio)))-2Pi

Input interpretation:

$$27\times\frac{1}{2}\left(\sqrt[128]{0.9+\frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}}-18+\phi\right)-2\pi$$

i is the imaginary unit

ϕ is the golden ratio

Result:

1728.836... +
24.00832... i

Polar coordinates:

$r = 1729.$ (radius), $\theta = 0.795614°$ (angle)

1729

This result is very near to the mass of candidate glueball $f_0(1710)$ 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)

From Wikipedia:

*"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".*

1/2 log base 144.92 ((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)))))

Input interpretation:

$$\frac{1}{2}\log_{144.92}\left(0.9+\frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}\right)$$

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

i is the imaginary unit

Result:

64.0000... +
0.157831... i

Polar coordinates:

$r = 64.0002$ (radius), $\theta = 0.141298°$ (angle)

64.0002

(((1/2 log base 144.92 ((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072))))))))^2

Input interpretation:

$$\left(\frac{1}{2}\log_{144.92}\left(0.9+\frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}\right)\right)^2$$

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

i is the imaginary unit

Result:

4095.98... +
20.2024... i

Polar coordinates:

$r = 4096.03$ (radius), $\theta = 0.282596°$ (angle)

4096.03

(((1/2 log base 144.92 ((((0.9 + (i*0.9*0.497)/(13.12806e+39)*((0.9*13.12806e+39)^8)/(3072)))))))^1/2

Input interpretation:

$$\sqrt{\frac{1}{2}\log_{144.92}\left(0.9+\frac{i\times 0.9\times 0.497}{13.12806\times 10^{39}}\times\frac{(0.9\times 13.12806\times 10^{39})^8}{3072}\right)}$$

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

i is the imaginary unit

Result:

8.00001... +
0.00986446... i

Polar coordinates:

$r = 8.00001$ (radius), $\theta = 0.0706489°$ (angle)

8.00001

We have that:

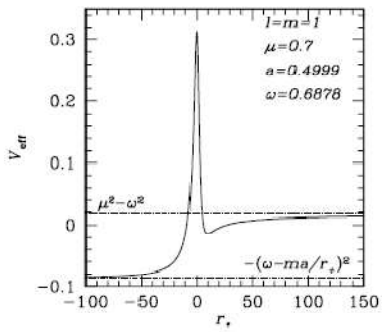


Figure 1: A typical form for the effective potential, here shown for $l = m = 1$ modes. We have set $M = 1$, so the rotation parameter a varies between 0 (Schwarzschild limit) and 1/2 (extremal limit). Here we plot the effective potential for the near extreme situation, $a \sim 0.5$ and for $\mu = 0.7$ and $\omega = 0.6878$.

We saw that the instability arises because of superradiantly amplified trapped modes, in the potential well. But does a well exist for general d? It doesn't, and to understand this, we have to look at the asymptotic behavior of the effective potential (2.10). If the derivative of this potential is positive near spatial infinity, we are guaranteed to have a well, and therefore an instability. If the derivative is negative, the modes should all be stable. Near infinity, the dominant terms in the effective potential (2.10) are

$$V' \sim -\frac{2}{r^3}(A_{lm} + a^2\mu^2 + \frac{n}{2} + \frac{n^2}{4} - a^2\omega^2) + (n+1)\mu^2 M r^{-2-n}\,, \tag{2.33}$$

where we have already substituted for the separation constant $\lambda = A_{lm} - 2am\omega + a^2\omega^2$. It is immediately apparent that the four dimensional case is a special one: if $n = 0$, the dominant term in the derivative is $(n+1)\mu^2 M r^{-2-n}$, which is positive and we therefore are guaranteed to have a bound state. Thus, this case should be unstable, and it is, as we just described in the previous subsection.

When $n > 0$ the other terms dominate. In fact, for $n > 1$ they are positive. For $n > 1$ the dominant terms are

$$V' \sim -\frac{2}{r^3}(A_{lm} + a^2\mu^2 + \frac{n}{2} + \frac{n^2}{4} - a^2\omega^2)\,. \tag{2.34}$$

Since $\omega < \mu$, this is negative (the separation constant A_{lm} can be shown to be positive). Thus, for $d > 5$ there is no potential well, no bound states and therefore no instability, even though there is still superradiance. The situation for $n = 1$ is not as clear, because there is the extra term $(n+1)\mu^2 M r^{-2-n}$. In principle it should be possible to have, for certain very specific parameters, a potential well. But to do that, one would have to require that μ be very large, and this makes it very hard to study the problem numerically (the imaginary part is expected to be extremely small in this regime, as shown by Zouros and Eardley [8], and this prevents any numerical treatment).

$A_{lm} = l(l+1)$

$= 2$

$$V' \sim -\frac{2}{r^3}(A_{lm} + a^2\mu^2 + \frac{n}{2} + \frac{n^2}{4} - a^2\omega^2) + (n+1)\mu^2 M r^{-2-n}$$

$$V' \sim -\frac{2}{r^3}(A_{lm} + a^2\mu^2 + \frac{n}{2} + \frac{n^2}{4} - a^2\omega^2)$$

for $l = m = 1$, $\mu = 0.9$ and $a = 0.497$..

$a \sim 0.5$ and for $\mu = 0.7$ and $\omega = 0.6878$

For Q = 6.19631e+26, M = 13.12806e+39, r = 1.94973e+13, μ = 0.7, a = 0.5, n = 2 and ω = 0.6878 , we obtain:

-2/(1.94973e+13)))^3*((((2+0.5^2*0.7^2+1+1-0.5^2*0.6878^2))))+3(0.7^2*(13.12806e+39)*(1.94973e+13)^(-2-2)

Input interpretation:

$$-\frac{2}{(1.94973\times10^{13})^3}(2+0.5^2\times0.7^2+1+1-0.5^2\times0.6878^2)+3(0.7^2\times13.12806\times10^{39}(1.94973\times10^{13})^{-2-2})$$

Result:

$1.3354265035571747591280441106549619175642269458742660... \times 10^{-13}$

$1.3354265035...*10^{-13}$

And:

-2/(1.94973e+13)^3*((((2+0.5^2*0.7^2+1+1-0.5^2*0.6878^2))))

Input interpretation:

$$-\frac{2}{(1.94973\times10^{13})^3}(2+0.5^2\times0.7^2+1+1-0.5^2\times0.6878^2)$$

Result:

$-1.0805027859293486373016923289033356139682994595919 60... \times 10^{-39}$

$-1.080502785929....*10^{-39}$

Note that this result is a sub-multiple of the following Ramanujan mock theta function value:

MOCK THETA ORDER 3

For $\phi(q)$ $q = -e^{-t}$, $t = 0.5$ $q^n = -21.79216 * -e^{-0.5}$, we obtain:

$$\phi(q) = 1 + \frac{q}{1+q^2} + \frac{q^4}{(1+q^2)(1+q^4)} + \dots$$

$$\psi(q) = \frac{q}{1-q} + \frac{q^4}{(1-q)(1-q^3)} + \frac{q^9}{(1-q)(1-q^3)(1-q^5)} + \dots$$

$$\chi(q) = 1 + \frac{q}{1-q+q^2} + \frac{q^4}{(1-q+q^2)(1-q^2+q^4)} + \dots$$

φ(q) = 1.075226 + 0.00572374 = **1.08094974**

1/(((-2/(1.94973e+13)^3*((((2+0.5^2*0.7^2+1+1-0.5^2*0.6878^2))))+3(0.7^2*(13.12806e+39)*(1.94973e+13)^(-2-2)))))^1/62

Input interpretation:

$$1/\left(\left(-\frac{2}{(1.94973\times 10^{13})^3}\left(2+0.5^2\times 0.7^2+1+1-0.5^2\times 0.6878^2\right)+3\left(0.7^2\times 13.12806\times 10^{39}\left(1.94973\times 10^{13}\right)^{-2-2}\right)\right)\hat{}\,(1/62)\right)$$

Result:

1.6130628547068963746879588761456361884250372455233647025 81...

1.6130628547… result that is near to the value of the golden ratio 1,618033988749...

2 log base 1.6130628547((1/(((-2/(1.94973e+13)^3*((((2+0.5^2*0.7^2+1+1-0.5^2*0.6878^2))))+3(0.7^2*(13.12806e+39)*(1.94973e+13)^(-2-2)))))))+Pi-2

Input interpretation:

$$2\log_{1.6130628547}\left(1/\left(-\frac{2}{(1.94973\times 10^{13})^3}\left(2+0.5^2\times 0.7^2+1+1-0.5^2\times 0.6878^2\right)+3\left(0.7^2\times 13.12806\times 10^{39}\left(1.94973\times 10^{13}\right)^{-2-2}\right)\right)\right)+\pi-2$$

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

Result:

125.142...

125.142… result 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

2 log base 1.6130628547((1/(((-2/(1.94973e+13)^3*((((2+0.5^2*0.7^2+1+1-0.5^2*0.6878^2))))+3(0.7^2*(13.12806e+39)*(1.94973e+13)^(-2-2)))))))+21-Pi-e

Input interpretation:

$$2\log_{1.6130628547}\left(1/\left(-\frac{2}{(1.94973\times 10^{13})^3}\left(2+0.5^2\times 0.7^2+1+1-0.5^2\times 0.6878^2\right)+3\left(0.7^2\times 13.12806\times 10^{39}\left(1.94973\times 10^{13}\right)^{-2-2}\right)\right)\right)+21-\pi-e$$

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

Result:

139.140...

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

Now, we have that:

In Boyer-Lindquist-type coordinates the black branes we study in this section are described by

$$ds^2 = -\frac{\Delta - a^2\sin^2\theta}{\Sigma}dt^2 - \frac{2a(r^2+a^2-\Delta)\sin^2\theta}{\Sigma}dtd\varphi + \frac{(r^2+a^2)^2-\Delta a^2\sin^2\theta}{\Sigma}\sin^2\theta d\varphi^2 + \frac{\Sigma}{\Delta}dr^2 + \Sigma d\theta^2 + r^2\cos^2\theta d\Omega_n^2 + dx^i dx_i, \quad (2.1)$$

where

$$\Sigma = r^2 + a^2\cos^2\theta\,, \quad \Delta = r^2 + a^2 - Mr^{1-n}, \quad (2.2)$$

The event horizon, homeomorphic to S^{2+n}, is located at $r = r_+$, such that $\Delta|_{r=r_+} = 0$. For $n = 0$, an event horizon exists only for $a < M/2$. When $n = 1$, an event horizon exists only when $a < \sqrt{M}$, and the event horizon shrinks to zero-area in the extreme limit $a \to \sqrt{M}$. On the other hand, when $n \geq 2$, $\Delta = 0$ has exactly one positive root for arbitrary $a > 0$. This means there is no bound on a, and thus there are no extreme Kerr black branes in higher dimensions.

We consider the ansatz $\phi = e^{-i\omega t + im\varphi + i\mu_i x^i}R(r)S(\theta)Y(\Omega)$, and substitute this form in (2.3), where $Y(\Omega)$ are hyperspherical harmonics on the n-sphere, with eigenvalues given by $-j(j+n-1)$ $(j = 0, 1, 2, \cdots)$.

We now present a full description of our search for bound states in general $(4+n)$-dimensions. We conclude that no unstable bound states exist for $n \geq 5$. The massive scalar field equation in 4+n dimensional spacetime is given by

$$\Delta r^{-n}\frac{d}{dr}\left(\Delta r^n \frac{dR}{dr}\right) + V_0 R = 0\,, \quad (A.1)$$

where V_0 is the effective potential, given by

$$V_0 = \{\omega(r^2+a^2) - am\}^2 - \Delta\left\{\mu^2 r^2 + A_{lm} - 2m\omega a + \omega^2 a^2 + \frac{j(j+n-1)a^2}{r^2}\right\}. \quad (A.2)$$

For simplicity, let us assume A_{lm} to be $A_{lm} = l(l+1)$. Note that this assumption is only valid in the limit

From:

$$\Delta = r^2 + a^2 - Mr^{1-n},$$

(1.94973e+13)^2+0.5^2-(((13.12806e+39)(1.94973e+13)^(-4)))

Input interpretation:

$$(1.94973\times 10^{13})^2 + 0.5^2 - \frac{13.12806\times 10^{39}}{(1.94973\times 10^{13})^4}$$

Result:

$3.80144707290000000000000002499999999999090915465962196... \times 10^{26}$

$3.8014470729\ldots*10^{26} = \Delta$

For

$A_{lm} = l(l+1)$

= 2

Q = 6.19631e+26, M = 13.12806e+39, r = 1.94973e+13, μ = 0.7, a = 0.5, n = 5 and ω = 0.6878 , l = m = 1, j = 2

from:

$$V_0 - \{\omega(r^2 + a^2) - am\}^2 - \Delta \left\{\mu^2 r^2 + A_{lm} - 2m\omega a + \omega^2 a^2 + \frac{j(j+n-1)a^2}{r^2}\right\} .$$

we obtain:

(((0.6878((1.94973e+13)^2+0.5^2)-0.5)))^2-3.8014470729e+26[((((0.7^2*(1.94973e+13)^2+2-2*0.6878*0.5+0.6878^2*0.5^2+(2(2+5-1)*0.5^2)/(1.94973e+13)^2))))]

Input interpretation:

$$(0.6878((1.94973\times10^{13})^2+0.5^2)-0.5)^2-3.8014470729\times10^{26}\left(0.7^2(1.94973\times10^{13})^2+2-2\times0.6878\times0.5+0.6878^2\times0.5^2+\frac{2(2+5-1)\times0.5^2}{(1.94973\times10^{13})^2}\right)$$

Result:

$-2.446721905874791756653420871330760652545039100000002... \times 10^{51}$

$-2.44672190587479...*10^{51}$

(((((((0.6878((1.94973e+13)^2+0.5^2)-0.5)))^2-3.8014470729e+26[((((0.7^2*(1.94973e+13)^2+2-2*0.6878*0.5+0.6878^2*0.5^2+(2(2+5-1)*0.5^2)/(1.94973e+13)^2))))]))))^1/248

Input interpretation:

$$\left((0.6878((1.94973\times10^{13})^2+0.5^2)-0.5)^2-3.8014470729\times10^{26}\left(0.7^2(1.94973\times10^{13})^2+2-2\times0.6878\times0.5+0.6878^2\times0.5^2+\frac{2(2+5-1)\times0.5^2}{(1.94973\times10^{13})^2}\right)\right)\hat{}\,(1/248)$$

Result:

$1.61130... + 0.0204126... i$

Polar coordinates:

$r = 1.61143$ (radius), $\theta = 0.725806°$ (angle)

1.61143 result that is near to the value of the golden ratio 1,618033988749...

1/2 log base 1.61143(((((((0.6878((1.94973e+13)^2+0.5^2)-0.5)))^2-3.8014470729e+26[((((0.7^2*(1.94973e+13)^2+2-2*0.6878*0.5+0.6878^2*0.5^2+(2(2+5-1)*0.5^2)/(1.94973e+13)^2))))]))))+Pi-2

Input interpretation:

$$\frac{1}{2}\log_{1.61143}\left((0.6878((1.94973\times10^{13})^2+0.5^2)-0.5)^2-3.8014470729\times10^{26}\left(0.7^2(1.94973\times10^{13})^2+2-2\times0.6878\times0.5+0.6878^2\times0.5^2+\frac{2(2+5-1)\times0.5^2}{(1.94973\times10^{13})^2}\right)\right)+\pi-2$$

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

Result:

$125.142... + 3.29223... i$

Polar coordinates:

$r = 125.185$ (radius), $\theta = 1.50699°$ (angle)

125.185 result 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

1/2 log base 1.61143(((((((0.6878((1.94973e+13)^2+0.5^2)-0.5)))^2-3.8014470729e+26[((((0.7^2*(1.94973e+13)^2+2-2*0.6878*0.5+0.6878^2*0.5^2+(2(2+5-1)*0.5^2)/(1.94973e+13)^2))))]))))+18-e

Input interpretation:

$$\frac{1}{2}\log_{1.61143}\left((0.6878((1.94973\times10^{13})^2+0.5^2)-0.5)^2-3.8014470729\times10^{26}\left(0.7^2(1.94973\times10^{13})^2+2-2\times0.6878\times0.5+0.6878^2\times0.5^2+\frac{2(2+5-1)\times0.5^2}{(1.94973\times10^{13})^2}\right)\right)+18-e$$

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

Result:

139.282... +
3.29223... i

Polar coordinates:

$r = 139.321$ (radius), $\theta = 1.35406°$ (angle)

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

From:

Shaun Cooper - **Ramanujan's Theta Functions**

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We have that:

We will now evaluate each of $X(q)$, $\varphi(q)$, and $P(q^2)$ in the special cases $q = \exp(-\pi\sqrt{3})$ and $q = \exp(-\pi\sqrt{7})$. We begin with the evaluations of X.

Lemma 14.2. *Let*

$$X = X(q) = q \prod_{j=1}^{\infty} \frac{(1-q^j)^{24}(1-q^{4j})^{24}}{(1-q^{2j})^{48}}.$$

Then

$$X\left(e^{-\pi\sqrt{3}}\right) = \frac{1}{256} \qquad \textit{and} \qquad X\left(e^{-\pi\sqrt{7}}\right) = \frac{1}{4096}.$$

product ((1-(exp(-Pi*sqrt3)^(n))))^24* (1-(exp(-Pi*sqrt3)^(4n)))^24/ ((1-(exp(-Pi*sqrt3)^(2n))))^48, n=1 to infinity

Input interpretation:

$$\prod_{n=1}^{\infty} \frac{(1-\exp^n(-\pi\sqrt{3}))^{24}\,(1-\exp^{4n}(-\pi\sqrt{3}))^{24}}{(1-\exp^{2n}(-\pi\sqrt{3}))^{48}}$$

Approximated product:

$$\prod_{n=1}^{\infty} \frac{\left(1-e^{-4\sqrt{3}\,n\pi}\right)^{24}\left(1-e^{-\sqrt{3}\,n\pi}\right)^{24}}{\left(1-e^{-2\sqrt{3}\,n\pi}\right)^{48}} \approx 0.901424$$

Partial product formula:

$$\prod_{n=1}^{m} \frac{\left(1-e^{-4\sqrt{3}\,n\pi}\right)^{24}\left(1-e^{-\sqrt{3}\,n\pi}\right)^{24}}{\left(1-e^{-2\sqrt{3}\,n\pi}\right)^{48}} = \frac{e^{-12\sqrt{3}\,\pi\, m(m+1)}\left(\left(-1;\, e^{2\sqrt{3}\,\pi}\right)_{m+1}\right)^{24}}{\left(\left(-1;\, e^{\sqrt{3}\,\pi}\right)_{m+1}\right)^{24}}$$

exp(-Pi*sqrt3) * 0.901424

Input interpretation:

$$\exp\left(-\pi\sqrt{3}\right)\times 0.901424$$

Result:

$0.00390625\ldots$

0.00390625….

Series representations:

$$\exp\left(-\pi\sqrt{3}\right) 0.901424 = 0.901424 \exp\left(-\pi\sqrt{2}\sum_{k=0}^{\infty} 2^{-k}\binom{\frac{1}{2}}{k}\right)$$

$$\exp\left(-\pi\sqrt{3}\right) 0.901424 = 0.901424 \exp\left(-\pi\sqrt{2}\sum_{k=0}^{\infty} \frac{\left(-\frac{1}{2}\right)^k \left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$\exp\left(-\pi\sqrt{3}\right) 0.901424 = 0.901424 \exp\left(-\frac{\pi \sum_{j=0}^{\infty} \operatorname{Res}_{s=-\frac{1}{2}+j} 2^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)$$

Input interpretation:

0.00390625

0.00390625

Rational form:

$$\frac{1}{256}$$

Possible closed forms:

$$\frac{1}{256} = 0.00390625$$

$$\frac{4\pi}{3217} \approx 0.00390623892$$

$$-\frac{e^{2-\pi}\sin^2(e\,\pi)\cos(e\,\pi)}{\pi^3} \approx 0.00390624668$$

1/ (exp(-Pi*sqrt3) * 0.901424)

Input interpretation:

$$\frac{1}{\exp(-\pi\sqrt{3})\times 0.901424}$$

Result:

256.000...

256

Series representations:

$$\frac{1}{\exp(-\pi\sqrt{3})\,0.901424} = \frac{1.10936}{\exp\left(-\pi\sqrt{2}\sum_{k=0}^{\infty} 2^{-k}\binom{\frac{1}{2}}{k}\right)}$$

$$\frac{1}{\exp(-\pi\sqrt{3})\,0.901424} = \frac{1.10936}{\exp\left(-\pi\sqrt{2}\sum_{k=0}^{\infty} \frac{\left(-\frac{1}{2}\right)^k \left(-\frac{1}{2}\right)_k}{k!}\right)}$$

$$\frac{1}{\exp(-\pi\sqrt{3})\,0.901424} = \frac{1.10936}{\exp\left(-\frac{\pi\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j} 2^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)}$$

And:

product ((1-(exp(-Pi*sqrt7)^(n))))^24* (1-(exp(-Pi*sqrt7)^(4n)))^24/ ((1-(exp(-Pi*sqrt7)^(2n))))^48, n=1 to infinity

Input interpretation:

$$\prod_{n=1}^{\infty} \frac{\left(1-\exp^n(-\pi\sqrt{7})\right)^{24}\left(1-\exp^{4n}(-\pi\sqrt{7})\right)^{24}}{\left(1-\exp^{2n}(-\pi\sqrt{7})\right)^{48}}$$

Approximated product:

$$\prod_{n=1}^{\infty} \frac{\left(1-e^{-4\sqrt{7}\,n\,\pi}\right)^{24}\left(1-e^{-\sqrt{7}\,n\,\pi}\right)^{24}}{\left(1-e^{-2\sqrt{7}\,n\,\pi}\right)^{48}} \approx 0.994124$$

0.994124 result very near to the dilaton value 0.989117352243 = ϕ

Partial product formula:

$$\prod_{n=1}^{m} \frac{\left(1-e^{-4\sqrt{7}\,n\,\pi}\right)^{24}\left(1-e^{-\sqrt{7}\,n\,\pi}\right)^{24}}{\left(1-e^{-2\sqrt{7}\,n\,\pi}\right)^{48}} = \frac{e^{-12\sqrt{7}\,\pi\,m\,(m+1)}\left(\left(-1;\,e^{2\sqrt{7}\,\pi}\right)_{m+1}\right)^{24}}{\left(\left(-1;\,e^{\sqrt{7}\,\pi}\right)_{m+1}\right)^{24}}$$

$(a;q)_n$ gives the q-Pochhammer symbol

exp(-Pi*sqrt7) * 0.994124

Input interpretation:

$$\exp\left(-\pi\sqrt{7}\right)\times 0.994124$$

Result:

0.000244140613534716771154973694240625738936834809066105453...

0.000244140613...

Series representations:

$$\exp\left(-\pi\sqrt{7}\right)0.994124 = 0.994124\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty} 6^{-k}\binom{\frac{1}{2}}{k}\right)$$

$$\exp\left(-\pi\sqrt{7}\right)0.994124 = 0.994124\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{6}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$\exp\left(-\pi\sqrt{7}\right)0.994124 = 0.994124\exp\left(-\frac{\pi\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j} 6^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)$$

We have:

0.000244140613

Input interpretation:

0.000244140613

Possible closed forms:

$$\frac{1}{4096} \approx 0.00024414062500 0$$

$$-e^{-2+9/e-e+2/\pi+2\pi}\,\pi^{-5-2e}\sin^2(e\pi)\cos^3(e\pi) \approx 0.000244140612998 1$$

$$\log\left(\frac{1}{2}\left(29+25\sqrt{2}+13e+22e^2-42\pi-13\pi^2\right)\right) \approx 0.000244140613400 58$$

log(x) is the natural logarithm

1/((exp(-Pi*sqrt7) * 0.994124))

Input interpretation:

$$\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}$$

Result:

4096.00...

4096 = 64^2

Series representations:

$$\frac{1}{\exp(-\pi\sqrt{7})\,0.994124} = \frac{1.00591}{\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty}6^{-k}\binom{\frac{1}{2}}{k}\right)}$$

$$\frac{1}{\exp(-\pi\sqrt{7})\,0.994124} = \frac{1.00591}{\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{6}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)}$$

$$\frac{1}{\exp(-\pi\sqrt{7})\,0.994124} = \frac{1.00591}{\exp\left(-\frac{\pi\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j} 6^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)}$$

sqrt(((1/((exp(-Pi*sqrt7) * 0.994124)))))

Input interpretation:

$$\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}}$$

Result:

64.0000...

64

All 2nd roots of 4096.:

$64.\,e^0 \approx 64.000$ (real, principal root)

$64.\,e^{i\pi} \approx -64.000$ (real root)

Series representations:

$$\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} = \sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}$$

$$\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} = \sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} = \sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{1.00591}{\exp(-\pi\sqrt{7})}-z_0\right)^k z_0^{-k}}{k!}$$

for not $((z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0))$

27 * sqrt(((1/((exp(-Pi*sqrt7) * 0.994124))))) + 1

Input interpretation:

$$27\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}}+1$$

Result:

1729.00...

1729

This result is very near to the mass of candidate glueball $f_0(1710)$ 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)

Series representations:

$$27\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+1=1+27\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}$$

$$27\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+1=1+27\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$27\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+1=1+27\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{1.00591}{\exp(-\pi\sqrt{7})}-z_0\right)^k z_0^{-k}}{k!}$$

for not $((z_0\in\mathbb{R}$ and $-\infty<z_0\leq 0))$

2 * sqrt(((1/((exp(-Pi*sqrt7) * 0.994124)))))-Pi+1/golden ratio

Input interpretation:

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}}-\pi+\frac{1}{\phi}$$

ϕ is the golden ratio

Result:

125.476...

125.476… result 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

Series representations:

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}-\pi+\frac{1}{\phi}=\frac{1}{\phi}-\pi+2\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}$$

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}-\pi+\frac{1}{\phi}=\frac{1}{\phi}-\pi+2\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}-\pi+\frac{1}{\phi}=\frac{1}{\phi}-\pi+2\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{1.00591}{\exp(-\pi\sqrt{7})}-z_0\right)^k z_0^{-k}}{k!}$$

for not $((z_0\in\mathbb{R}$ and $-\infty<z_0\leq 0))$

2 * sqrt(((1/((exp(-Pi*sqrt7) * 0.994124)))))+11+1/golden ratio

Input interpretation:

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}}+11+\frac{1}{\phi}$$

ϕ is the golden ratio

Result:

139.618...

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

Series representations:

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+11+\frac{1}{\phi}=11+\frac{1}{\phi}+2\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}$$

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+11+\frac{1}{\phi}=11+\frac{1}{\phi}+2\sqrt{-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-1+\frac{1.00591}{\exp(-\pi\sqrt{7})}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$2\sqrt{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}}+11+\frac{1}{\phi}=11+\frac{1}{\phi}+2\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{1.00591}{\exp(-\pi\sqrt{7})}-z_0\right)^k z_0^{-k}}{k!}$$

for not $((z_0\in\mathbb{R}$ and $-\infty<z_0\leq 0))$

(((1/ ((exp(-Pi*sqrt7)) * 0.994124))))^1/17 - 13*1/10^3

Input interpretation:

$$\sqrt[17]{\frac{1}{\exp(-\pi\sqrt{7})\times 0.994124}} - 13\times\frac{1}{10^3}$$

Result:

1.6181419714715128412121875324891819919324287103115561080 68...

1.61814197147… result that is a very good approximation to the value of the golden ratio 1,618033988749...

Series representations:

$$\sqrt[17]{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} - \frac{13}{10^3} = -0.013 + 1.00035\sqrt[17]{\frac{1}{\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty} 6^{-k}\binom{\frac{1}{2}}{k}\right)}}$$

$$\sqrt[17]{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} - \frac{13}{10^3} = -0.013 + 1.00035\sqrt[17]{\frac{1}{\exp\left(-\pi\sqrt{6}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{6}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)}}$$

$$\sqrt[17]{\frac{1}{\exp(-\pi\sqrt{7})\,0.994124}} - \frac{13}{10^3} = -0.013 + 1.00035\sqrt[17]{\frac{1}{\exp\left(-\frac{\pi\sum_{j=0}^{\infty}\text{Res}_{s=-\frac{1}{2}+j}\,6^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)}}$$

From:

Theorem 10.1. *The following identities hold:*

$$1 + k = \prod_{j=1}^{\infty} \frac{(1-q^{10j-8})^2(1-q^{10j-5})^2(1-q^{10j-2})^2}{(1-q^{10j-9})(1-q^{10j-6})^2(1-q^{10j-4})^2(1-q^{10j-1})}$$

.

For j = 2 and q = 0.5, we obtain:

((((1-0.5^12)^2(1-0.5^15)^2(1-0.5^18)^2))) / (((1-0.5^11)(1-0.5^14)^2(1-0.5^16)^2(1-0.5^19)))

Input:

$$\frac{(1-0.5^{12})^2 (1-0.5^{15})^2 (1-0.5^{18})^2}{(1-0.5^{11})(1-0.5^{14})^2 (1-0.5^{16})^2 (1-0.5^{19})}$$

Result:

1.0000858970253762645612449126270183978317333792711665939 71...

1.00008589702537…

And:

product ((((1-0.5^(10j-8))^2(1-0.5^(10j-5))^2(1-0.5^(10j-2))^2))) / (((1-0.5^(10j-9))(1-0.5^(10j-6))^2(1-0.5^(10j-4)^2)(1-0.5^(10j-1)))), j=1 to infinity

Input interpretation:

$$\prod_{j=1}^{\infty} \frac{(1-0.5^{10j-8})^2 (1-0.5^{10j-5})^2 (1-0.5^{10j-2})^2}{(1-0.5^{10j-9})(1-0.5^{10j-6})^2 \left(1-0.5^{(10j-4)^2}\right)(1-0.5^{10j-1})}$$

Approximated product:

$$\prod_{j=1}^{\infty} \frac{(1-0.5^{-8+10j})^2 (1-0.5^{-5+10j})^2 (1-0.5^{-2+10j})^2}{(1-0.5^{-9+10j})(1-0.5^{-6+10j})^2 \left(1-0.5^{(-4+10j)^2}\right)(1-0.5^{-1+10j})} \approx 1.19428$$

1.19428

((((1.19428)^(e) - 2*1/10^3)))

Input interpretation:

$$1.19428^e - 2\times\frac{1}{10^3}$$

Result:

1.618303134351482805153132024801340292197383348741653854191...

1.61830313435… result that is a very good approximation to the value of the golden ratio 1,618033988749...

(((exp((((1.19428))))^4)))+7-1/golden ratio

Input interpretation:

$$\exp^4(1.19428)+7-\frac{1}{\phi}$$

ϕ is the golden ratio

Result:

125.144...

125.144... result 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

(((exp((((1.19428))))^4)))+18+golden ratio^2

Input interpretation:

$$\exp^4(1.19428)+18+\phi^2$$

ϕ is the golden ratio

Result:

139.380...

139.380... result practically equal to the rest mass of Pion meson 139.57 MeV

Now, we have that (page 524):

$$1-k=\prod_{j=1}^{\infty}\frac{(1-q^{10j-9})(1-q^{10j-6})(1-q^{10j-5})^2(1-q^{10j-4})(1-q^{10j-1})}{(1-q^{10j-8})(1-q^{10j-7})^2(1-q^{10j-3})^2(1-q^{10j-2})}.$$

product (((1-0.5^(10j-9))(1-0.5^(10j-6))(1-0.5^(10j-5))^2))(1-0.5^(10j-4))(1-0.5^(10j-1)) / (((1-0.5^(10j-8))(1-0.5^(10j-7))^2(1-0.5^(10j-3))^2)(1-0.5^(10j-2))), j=1 to infinity

Input interpretation:

$$\prod_{j=1}^{\infty}\frac{((1-0.5^{10j-9})(1-0.5^{10j-6})(1-0.5^{10j-5})^2)(1-0.5^{10j-4})(1-0.5^{10j-1})}{((1-0.5^{10j-8})(1-0.5^{10j-7})^2(1-0.5^{10j-3})^2)(1-0.5^{10j-2})}$$

Infinite product:

$$\prod_{j=1}^{\infty}\frac{(1-0.5^{10j-9})(1-0.5^{10j-6})(1-0.5^{10j-5})^2(1-0.5^{10j-4})(1-0.5^{10j-1})}{(1-0.5^{10j-8})(1-0.5^{10j-7})^2(1-0.5^{10j-3})^2(1-0.5^{10j-2})}=0.767466$$

0.767466

1/(0.767466)

Input interpretation:

$$\frac{1}{0.767466}$$

Result:

1.302989318093570268910935468151032097838861917010004351984...

1.302989318….

((2/(0.767466)))^1/2

Input interpretation:

$$\sqrt{\frac{2}{0.767466}}$$

Result:

1.614304381517667980160765852068370595552962734184062492063...

1.61430438151…. result that is a good approximation to the value of the golden ratio 1,618033988749...

1/ ((2/(0.767466)))^1/2

Input interpretation:

$$\frac{1}{\sqrt{\frac{2}{0.767466}}}$$

Result:

0.619461863232919287031031162711752053743325048876652852266...

0.6194618632329….. result that is a good approximation to the value of the golden ratio conjugate 0,618033988749...

(0.767466)^1/64

Input interpretation:

$$\sqrt[64]{0.767466}$$

Result:

0.99587321...

0.99587321... result very near to the dilaton value 0.989117352243 = ϕ

2 log base 0.99587321(0.767466)-Pi+1/golden ratio

Input interpretation:

$$2 \log_{0.99587321}(0.767466) - \pi + \frac{1}{\phi}$$

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

ϕ is the golden ratio

Result:

125.476...

125.476... result 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

Alternative representation:

$$2 \log_{0.995873}(0.767466) - \pi + \frac{1}{\phi} = -\pi + \frac{1}{\phi} + \frac{2 \log(0.767466)}{\log(0.995873)}$$

Series representations:

$$2 \log_{0.995873}(0.767466) - \pi + \frac{1}{\phi} = \frac{1}{\phi} - \pi - \frac{2 \sum_{k=1}^{\infty} \frac{(-1)^k (-0.232534)^k}{k}}{\log(0.995873)}$$

$$2 \log_{0.995873}(0.767466) - \pi + \frac{1}{\phi} =$$
$$\frac{1}{\phi} - \pi - 483.638 \log(0.767466) - 2 \log(0.767466) \sum_{k=0}^{\infty} (-0.00412679)^k G(k)$$
$$\text{for } \left(G(0) = 0 \text{ and } G(k) = \frac{(-1)^{1+k} k}{2(1+k)(2+k)} + \sum_{j=1}^{k} \frac{(-1)^{1+j} G(-j+k)}{1+j}\right)$$

2 log base 0.99587321(0.767466)+11+1/golden ratio

Input interpretation:

$$2 \log_{0.99587321}(0.767466) + 11 + \frac{1}{\phi}$$

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

ϕ is the golden ratio

Result:

139.618...

139.618... result practically equal to the rest mass of Pion meson 139.57 MeV

Alternative representation:

$$2 \log_{0.995873}(0.767466) + 11 + \frac{1}{\phi} = 11 + \frac{1}{\phi} + \frac{2 \log(0.767466)}{\log(0.995873)}$$

Series representations:

$$2 \log_{0.995873}(0.767466) + 11 + \frac{1}{\phi} = 11 + \frac{1}{\phi} - \frac{2 \sum_{k=1}^{\infty} \frac{(-1)^k (-0.232534)^k}{k}}{\log(0.995873)}$$

$$2 \log_{0.995873}(0.767466) + 11 + \frac{1}{\phi} = 11 + \frac{1}{\phi} - 483.638 \log(0.767466) - 2 \log(0.767466) \sum_{k=0}^{\infty} (-0.00412679)^k G(k)$$

$$\text{for } \left(G(0) = 0 \text{ and } G(k) = \frac{(-1)^{1+k} k}{2(1+k)(2+k)} + \sum_{j=1}^{k} \frac{(-1)^{1+j} G(-j+k)}{1+j} \right)$$

27 log base 0.99587321(0.767466) + 1

Input interpretation:

$$27 \log_{0.99587321}(0.767466) + 1$$

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

Result:

1729.00...

1729

This result is very near to the mass of candidate glueball $f_0(1710)$ 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)

Alternative representation:

$$27 \log_{0.995873}(0.767466) + 1 = 1 + \frac{27 \log(0.767466)}{\log(0.995873)}$$

Series representations:

$$27 \log_{0.995873}(0.767466) + 1 = 1 - \frac{27 \sum_{k=1}^{\infty} \frac{(-1)^k (-0.232534)^k}{k}}{\log(0.995873)}$$

$$27 \log_{0.995873}(0.767466) + 1 =$$
$$1 - 6529.12 \log(0.767466) - 27 \log(0.767466) \sum_{k=0}^{\infty} (-0.00412679)^k G(k)$$
$$\text{for } \left(G(0) = 0 \text{ and } G(k) = \frac{(-1)^{1+k} k}{2(1+k)(2+k)} + \sum_{j=1}^{k} \frac{(-1)^{1+j} G(-j+k)}{1+j}\right)$$

Observations

DILATON VALUE CALCULATIONS

from:

Modular equations and approximations to π - *Srinivasa Ramanujan*
Quarterly Journal of Mathematics, XLV, 1914, 350 – 372

We have that:

5. Since G_n and g_n can be expressed as roots of algebraical equations with rational coefficients, the same is true of G_n^{24} or g_n^{24}. So let us suppose that

$$1 = ag_n^{-24} - bg_n^{-48} + \cdots,$$

or

$$g_n^{24} = a - bg_n^{-24} + \cdots.$$

But we know that

$$\begin{aligned} 64e^{-\pi\sqrt{n}}g_n^{24} &= 1 - 24e^{-\pi\sqrt{n}} + 276e^{-2\pi\sqrt{n}} - \cdots, \\ 64g_n^{24} &= e^{\pi\sqrt{n}} - 24 + 276e^{-\pi\sqrt{n}} - \cdots, \\ 64a - 64bg_n^{-24} + \cdots &= e^{\pi\sqrt{n}} - 24 + 276e^{-\pi\sqrt{n}} - \cdots, \\ 64a - 4096be^{-\pi\sqrt{n}} + \cdots &= e^{\pi\sqrt{n}} - 24 + 276e^{-\pi\sqrt{n}} - \cdots, \end{aligned}$$

that is

$$e^{\pi\sqrt{n}} = (64a + 24) - (4096b + 276)e^{-\pi\sqrt{n}} + \cdots \tag{13}$$

Similarly, if

$$1 = aG_n^{-24} - bG_n^{-48} + \cdots,$$

then

$$e^{\pi\sqrt{n}} = (64a - 24) - (4096b + 276)e^{-\pi\sqrt{n}} + \cdots \tag{14}$$

From (13) and (14) we can find whether $e^{\pi\sqrt{n}}$ is very nearly an integer for given values of n, and ascertain also the number of 9's or 0's in the decimal part. But if G_n and g_n be simple quadratic surds we may work independently as follows. We have, for example,

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

Hence

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

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

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

Again

$$G_{37} = (6+\sqrt{37})^{\frac{1}{4}},$$

$$\begin{aligned} 64G_{37}^{24} &= e^{\pi\sqrt{37}} + 24 + 276e^{-\pi\sqrt{37}} + \cdots, \\ 64G_{37}^{-24} &= \qquad\qquad 4096e^{-\pi\sqrt{37}} - \cdots, \end{aligned}$$

so that

$$64(G_{37}^{24} + G_{37}^{-24}) = e^{\pi\sqrt{37}} + 24 + 4372e^{-\pi\sqrt{37}} - \cdots = 64\{(6+\sqrt{37})^{6} + (6-\sqrt{37})^{6}\}.$$

Hence

$$e^{\pi\sqrt{37}} = 199148647.999978\ldots.$$

Similarly, from

$$g_{58} = \sqrt{\left(\frac{5+\sqrt{29}}{2}\right)},$$

we obtain

$$64(g_{58}^{24} + g_{58}^{-24}) = e^{\pi\sqrt{58}} - 24 + 4372e^{-\pi\sqrt{58}} + \cdots = 64\left\{\left(\frac{5+\sqrt{29}}{2}\right)^{12} + \left(\frac{5-\sqrt{29}}{2}\right)^{12}\right\}.$$

Hence

$$e^{\pi\sqrt{58}} = 24591257751.99999982\ldots.$$

From:

An Update on Brane Supersymmetry Breaking
J. Mourad and A. Sagnotti - arXiv:1711.11494v1 [hep-th] 30 Nov 2017

Now, we have that:

From the following vacuum equations:

$$T\, e^{\gamma_E \phi} = -\frac{\beta_E^{(p)}\, h^2}{\gamma_E}\, e^{-2(8-p)C + 2\beta_E^{(p)}\phi}$$

$$16\, k'\, e^{-2C} = \frac{h^2 \left(p + 1 - \frac{2\beta_E^{(p)}}{\gamma_E}\right) e^{-2(8-p)C + 2\beta_E^{(p)}\phi}}{(7-p)}$$

$$(A')^2 = k\, e^{-2A} + \frac{h^2}{16(p+1)} \left(7 - p + \frac{2\beta_E^{(p)}}{\gamma_E}\right) e^{-2(8-p)C + 2\beta_E^{(p)}\phi}$$

We have obtained, from the results almost equals of the equations, putting

$4096\, e^{-\pi\sqrt{18}}$ instead of

$$e^{-2(8-p)C + 2\beta_E^{(p)}\phi}$$

a new possible mathematical connection between the two exponentials. Thence, also the values concerning p, C, β_E and ϕ correspond to the exponents of *e* (i.e. of exp). Thence we obtain for p = 5 and $\beta_E = 1/2$:

$$e^{-6C+\phi} = 4096 e^{-\pi\sqrt{18}}$$

Therefore with respect to the exponential of the vacuum equation, the Ramanujan's exponential has a coefficient of 4096 which is equal to 64^2, while -6C+ϕ is equal to -$\pi\sqrt{18}$. From this it follows that it is possible to establish mathematically, the dilaton value.

phi = -Pi*sqrt(18) + 6C, for C = 1, we obtain:

exp((-Pi*sqrt(18))

Input:

$\exp\left(-\pi\sqrt{18}\right)$

Exact result:

$e^{-3\sqrt{2}\,\pi}$

Decimal approximation:

$1.6272016226072509292942156739117979541838581136954016... \times 10^{-6}$

$1.6272016... * 10^{-6}$

Now:

$$e^{-6C+\phi} = 4096e^{-\pi\sqrt{18}}$$

$e^{-\pi\sqrt{18}} = 1.6272016... * 10^{-6}$

$\frac{1}{4096}e^{-6C+\phi} = 1.6272016... * 10^{-6}$

$0.000244140625\, e^{-6C+\phi} = e^{-\pi\sqrt{18}} = 1.6272016... * 10^{-6}$

$\ln\left(e^{-\pi\sqrt{18}}\right) = -13.328648814475 = -\pi\sqrt{18}$

(1.6272016* 10^-6) *1/ (0.000244140625)

Input interpretation:

$\frac{1.6272016}{10^6} \times \frac{1}{0.000244140625}$

Result:

0.0066650177536

0.006665017...

$0.000244140625\, e^{-6C+\phi} = e^{-\pi\sqrt{18}}$

Dividing both sides by 0.000244140625, we obtain:

$$\frac{0.000244140625}{0.000244140625} e^{-6C+\phi} = \frac{1}{0.000244140625} e^{-\pi\sqrt{18}}$$

$e^{-6C+\phi}$ = 0.0066650177536

((((exp((-Pi*sqrt(18)))))))*1/0.000244140625

Input interpretation:

$$\exp\left(-\pi\sqrt{18}\right) \times \frac{1}{0.000244140625}$$

Result:

0.00666501785...

0.00666501785…

$e^{-6C+\phi}$ = 0.0066650177536

$$\exp\left(-\pi\sqrt{18}\right) \times \frac{1}{0.000244140625} =$$

$$e^{-\pi\sqrt{18}} \times \frac{1}{0.000244140625}$$

= 0.00666501785…

ln(0.00666501784619)

Input interpretation:

log(0.00666501784619)

Result:

-5.010882647757...

-5.010882647757…

Now:

$$-6C + \phi = -5.010882647757 \ldots$$

For C = 1, we obtain:

$\phi = -5.010882647757 + 6 = \mathbf{0.989117352243} = \boldsymbol{\phi}$

Ramanujan formula for obtain the golden ratio

1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))

Input:

$$\frac{1}{\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}}$$

Exact result:

$$\frac{1}{\frac{1}{32}\left(\sqrt{5}-1\right)^5+5\,e^{-25\sqrt{5}\,\pi^5}}$$

Decimal approximation:

11.090169943749474241022934171828190588601545899028814310677...

(11*5*(e^((-sqrt(5)*Pi))^5))) / (((2*(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))

Input:

$$\frac{11\times5\,e^{\left(-\sqrt{5}\,\pi\right)^5}}{2\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)}$$

Exact result:

$$\frac{55\,e^{-25\sqrt{5}\,\pi^5}}{2\left(\frac{1}{32}\left(\sqrt{5}-1\right)^5+5\,e^{-25\sqrt{5}\,\pi^5}\right)}$$

Decimal approximation:

$9.9929022507071872307053630412945712274243697626525\ldots\times10^{-7428}$

(5sqrt(5)*5*(e^((-sqrt(5)*Pi))^5))) / (((2*(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))

Input:

$$\frac{5\sqrt{5}\times 5\, e^{\left(-\sqrt{5}\,\pi\right)^5}}{2\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\, e^{\left(-\sqrt{5}\,\pi\right)^5}\right)}$$

Exact result:

$$\frac{25\sqrt{5}\, e^{-25\sqrt{5}\,\pi^5}}{2\left(\frac{1}{32}\left(\sqrt{5}-1\right)^5+5\, e^{-25\sqrt{5}\,\pi^5}\right)}$$

Decimal approximation:

$1.0156731238678143887477757629564691789882352909878 4\ldots \times 10^{-7427}$

From which:

Input interpretation:

$$\left(1\Big/\left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\, e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{9.992902250707187230705363041294571227424369762652 55}{10^{7428}}-\frac{1.0156731238678143887477757629564691789882352909878 4}{10^{7427}}\right)\right)\text{^}(1/5)$$

Result:

1.6180339887498948482045868343656381177203091798057628621 35...

Or:

((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))-(-1.63828987970956656772394588270120562457983147225 84 × 10^-7429)))^1/5

Input interpretation:

$$\sqrt[5]{\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\, e^{\left(-\sqrt{5}\,\pi\right)^5}\right)--\frac{1.63828987970956656772394588270120562457983147225 84}{10^{7429}}}}$$

Result:

1.618033988749894848204586834365638117720309179805762862135...

The result, thence, is:

1.6180339887498948482045868343656381177203091798057628

This is a wonderful golden ratio, fundamental constant of various fields of mathematics and physics

Continued fraction:

$$1+\cfrac{1}{\cdots}}}}}}}}}}}}}}}}}}}}}}}$$

Possible closed forms:

$\phi \approx 1.618033988749894848204586834365638117720309179805762862135$

$\Phi + 1 \approx 1.618033988749894848204586834365638117720309179805762862135$

$\frac{1}{\Phi} \approx 1.618033988749894848204586834365638117720309179805762862135$

Conclusions

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

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

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*

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