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

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Abstract

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

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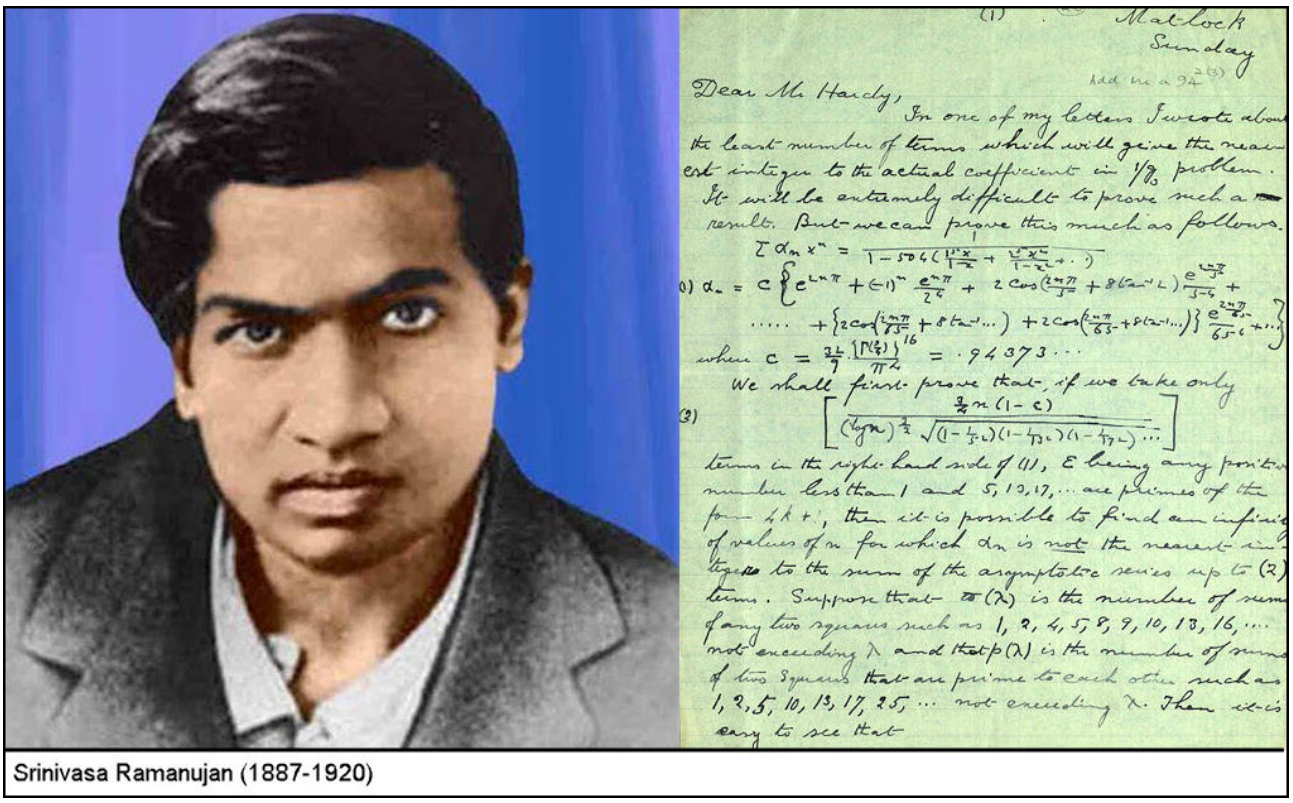


Srinivasa Ramanujan (1887-1920)

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

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

From:

Primordial Black Holes from Inflation and non-Gaussianity
G. Franciolini, A. Kehagias, S. Matarrese and A. Riotto - arXiv:1801.09415v2 [astro-ph.CO] 12 Mar 2018

We have that:

$$\begin{aligned}\sum_{n=3}^{\infty}\frac{(-1)^n}{n!}\xi_R^{(n)}(0)\,(\zeta_c/\sigma_R^2)^n &\supset \frac{1}{\sigma_{R_H}^2}\sum_{n=3}^{\infty}\frac{(-1)^n}{n!}s_n\,\zeta_c^n \\ &= \frac{1}{\sigma_{R_H}^2}\sum_{n=3}^{\infty}(-1)^n\frac{3^{n-2}}{n-1}\,\zeta_c^n \\ &= -\frac{\zeta_c^2}{\sigma_{R_H}^2}\left[1-\frac{1}{3\zeta_c}\ln\left(1+3\zeta_c\right)\right]. \qquad (4.13)\end{aligned}$$

$$P_1(\zeta_R>\zeta_c)=\frac{e^{-\nu^2/2}}{\sqrt{2\pi\nu^2}}\xrightarrow{\zeta_c=1/3}P_{\rm NG}(\zeta_R>\zeta_c)\simeq\frac{e^{-1.6\,\nu^2/2}}{\sqrt{2\pi\nu^2}} \qquad (4.14)$$

This is not at all an insignificant effect for $\nu \gg 1$. For instance one can ask what is the impact on the PBH abundance at formation. We follow Ref. [32] and we set $\beta_{\rm prim}(M)$ such that it corresponds today to a totality of the dark matter in the form of PBHs. Choosing $\zeta_c \simeq 1/3$, a Gaussian probability would give $\sigma_{R_H} \gtrsim 0.036$, while the non-Gaussian result (4.14) would deliver a result smaller than about ten orders of magnitude. This shows the large sensitivity of the non-Gaussian result to the cosmological observables. Of course, this is not the final result as there are other contributions to

From (4.13), we obtain:

(-1/9)/(0.037)^2 [(1-1/(1/3) ln(1+3*1/3)]

Input:

$$-\frac{1}{9\times 0.037^2}\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+3\times\frac{1}{3}\right)\right)$$

$\log(x)$ is the natural logarithm

Result:

112.515...

112.515…

Alternative representations:

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2}=-\frac{\log_e(2)\left(1-\frac{1}{\frac{1}{3}}\right)}{9\times 0.037^2}$$

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2}=-\frac{\log(a)\log_a(2)\left(1-\frac{1}{\frac{1}{3}}\right)}{9\times 0.037^2}$$

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2}=\frac{\mathrm{Li}_1(-1)\left(1-\frac{1}{\frac{1}{3}}\right)}{9\times 0.037^2}$$

Series representations:

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2}=$$
$$324.649\,i\,\pi\left\lfloor\frac{\arg(2-x)}{2\pi}\right\rfloor+162.324\log(x)-162.324\sum_{k=1}^{\infty}\frac{(-1)^k(2-x)^k x^{-k}}{k}\quad\text{for } x<0$$

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2}=162.324\left\lfloor\frac{\arg(2-z_0)}{2\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+162.324\log(z_0)+$$
$$162.324\left\lfloor\frac{\arg(2-z_0)}{2\pi}\right\rfloor\log(z_0)-162.324\sum_{k=1}^{\infty}\frac{(-1)^k(2-z_0)^k z_0^{-k}}{k}$$

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2} = 324.649\,i\,\pi\left[-\frac{-\pi+\arg\left(\frac{2}{z_0}\right)+\arg(z_0)}{2\,\pi}\right]+$$
$$162.324\log(z_0)-162.324\sum_{k=1}^{\infty}\frac{(-1)^k\,(2-z_0)^k\,z_0^{-k}}{k}$$

Integral representations:

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2} = 162.324\int_1^2\frac{1}{t}\,dt$$

$$\frac{\left(\left(1-\frac{1}{\frac{1}{3}}\right)\log\left(1+\frac{3}{3}\right)\right)(-1)}{9\times 0.037^2} = \frac{81.1622}{i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds \quad \text{for } -1<\gamma<0$$

From which:

1/4*(-1/9)/(0.037)^2 [(1-3) ln(1+3*1/3)]

Input:

$$\frac{1}{4}\left(-\frac{1}{9\times 0.037^2}\right)\left((1-3)\log\left(1+3\times\frac{1}{3}\right)\right)$$

$\log(x)$ is the natural logarithm

Result:

28.1287...

28.1287…

Alternative representations:

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4} = \frac{2\log_e(2)}{4\times 9\times 0.037^2}$$

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=\frac{2\log(a)\log_a(2)}{4\times 9\times 0.037^2}$$

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=-\frac{2\,\mathrm{Li}_1(-1)}{4\times 9\times 0.037^2}$$

Series representations:

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=$$
$$81.1622\,i\,\pi\left\lfloor\frac{\arg(2-x)}{2\,\pi}\right\rfloor+40.5811\log(x)-40.5811\sum_{k=1}^{\infty}\frac{(-1)^k\,(2-x)^k\,x^{-k}}{k}\quad\text{for } x<0$$

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=40.5811\left\lfloor\frac{\arg(2-z_0)}{2\,\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+40.5811\log(z_0)+$$
$$40.5811\left\lfloor\frac{\arg(2-z_0)}{2\,\pi}\right\rfloor\log(z_0)-40.5811\sum_{k=1}^{\infty}\frac{(-1)^k\,(2-z_0)^k\,z_0^{-k}}{k}$$

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=81.1622\,i\,\pi\left\lfloor-\frac{-\pi+\arg\left(\frac{2}{z_0}\right)+\arg(z_0)}{2\,\pi}\right\rfloor+$$
$$40.5811\log(z_0)-40.5811\sum_{k=1}^{\infty}\frac{(-1)^k\,(2-z_0)^k\,z_0^{-k}}{k}$$

Integral representations:

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=40.5811\int_1^2\frac{1}{t}\,dt$$

$$-\frac{(1-3)\log\left(1+\frac{3}{3}\right)}{(9\times 0.037^2)\,4}=\frac{20.2906}{i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\quad\text{for } -1<\gamma<0$$

With regard the number 28 we have:

From:

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

We have that:

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

The non-Gaussianity plays a fundamental role in determining the final PBH abundance.
Choosing $\zeta_c \approx 1/3$, a Gaussian probability would give $\sigma R_H \geq 0.036$, while the non-Gaussian result (4.14) would deliver a result smaller than about ten orders of magnitude.

From (4.14)

$$P_{\rm NG}(\zeta_R > \zeta_c) \simeq \frac{e^{-1.6\nu^2/2}}{\sqrt{2\pi\nu^2}}$$

For:

$$\nu \gg 1. = 146.19 = 12\, e^{5/2} \approx 146.189927$$

We obtain:

exp(-1.6*(12 e^(5/2))^2/2) / sqrt(2Pi*(12 e^(5/2))^2)

Input:

$$\frac{\exp\left(-1.6\left(\frac{1}{2}\left(12\,e^{5/2}\right)^2\right)\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}}$$

Result:

$1.652512670113509320106418463086544383578223074115 59\ldots \times 10^{-7428}$

$1.6525126701135\ldots*10^{-7428}$

Alternative representations:

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,w^{a}\right)^2\right)}{\sqrt{2\,\pi\left(12\,w^{a}\right)^2}} \quad \text{for } 2\,a = \frac{5}{\log(w)}$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,z^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,z^{5/2}\right)^2}} \quad \text{for } z = e$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(-0.8\left(12\left(1+\frac{2}{-1+\coth\left(\frac{5}{4}\right)}\right)\right)^2\right)}{\sqrt{2\,\pi\left(12\left(1+\frac{2}{-1+\coth\left(\frac{5}{4}\right)}\right)\right)^2}}$$

Series representations:

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(-115.2\sum_{k=-\infty}^{\infty} I_k(5)\right)}{\sqrt{-1+288\,e^5\,\pi}\,\sum_{k=0}^{\infty}\left(-1+288\,e^5\,\pi\right)^{-k}\binom{\frac{1}{2}}{k}}$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(-115.2\sum_{k=0}^{\infty}\frac{5^k}{k!}\right)}{\exp\left(i\,\pi\left\lfloor\frac{\arg\left(288\,e^5\,\pi-x\right)}{2\,\pi}\right\rfloor\right)\sqrt{x}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(288\,e^5\,\pi-x\right)^k x^{-k}\left(-\frac{1}{2}\right)_k}{k!}} \quad \text{for } (x\in\mathbb{R} \text{ and } x<0)$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\left(12\,e^{5/2}\right)^2\right)}{\sqrt{2\pi\left(12\,e^{5/2}\right)^2}} = \frac{\exp\left(-115.2\sum_{k=-\infty}^{\infty} I_k(5)\right)}{\exp\left(i\pi\left\lfloor\frac{\arg\left(288\,e^5-x\right)}{2\pi}\right\rfloor\right)\sqrt{x}\sum_{k=0}^{\infty}\frac{(-1)^k\left(288\,e^5-x\right)^k x^{-k}\left(-\frac{1}{2}\right)_k}{k!}}$$

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

$I_n(z)$ is the modified Bessel function of the first kind

Or, for:

$\nu \gg 1. = 144$

e^(-1.6*144^2*1/2)/((2Pi*144^2)^0.5)

Input:

$$\frac{e^{-1.6\times 144^2\times 1/2}}{\sqrt{2\pi\times 144^2}}$$

Result:

$1.042908427877424818569361856530176016929866483781 73\ldots \times 10^{-7207}$

$1.042908427877\ldots*10^{-7207}$

From:

https://blog.wolfram.com/2013/05/01/after-100-years-ramanujan-gap-filled/

Now, we describe the following Ramanujan formula for to obtain a very precise value of the golden ratio.

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

Thence:

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

Input:

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

Open code

Enlarge Data Customize A Plaintext Interactive

Exact result:

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

Decimal approximation:

- More digits

11.090169943749474241022934171828190588601545899028814310 67...

Open code

11.0901699…

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

Input:

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

Open code

Enlarge Data Customize A Plaintext Interactive

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:

- More digits

$9.9929022507071872307053630412945712274243697626525 5\ldots \times 10^{-7428}$

Open code

$9.99290225\ldots *10^{-7428}$

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

Input:

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

Open code

Enlarge Data Customize A Plaintext Interactive

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:

- More digits

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

Open code

$1.0156731238\ldots *10^{-7427}$

Input interpretation:

$$\left(1\Big/\left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{\frac{9.9929022507071872307053630412945712274243697626525 5}{10^{7428}}}{\frac{1.0156731238678143887477757629564691789882352909878 4}{10^{7427}}}\right)\right)\wedge(1/5)$$

Open code

(((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))-(9.9929022507071872307053630412945712274243697626525 5 × 10^-7428) -(1.0156731238678143887477757629564691789882352909878 4 × 10^-7427))))))^1/5

Enlarge Data Customize A Plaintext Interactive

Result:

- More digits

$1.6180339887498948482045868343656381177203091798057628621 35\ldots$

$1.61803398\ldots$

Or:

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

Input interpretation:

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

Open code

Enlarge Data Customize A Plaintext Interactive

Result:

- More digits

1.6180339887498948482045868343656381177203091798057628 62135...

The result, thence, is:

1.6180339887498948482045868343656381177203091798057628

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

If we put in the Ramanujan expression, the above value, i.e.

1.6525126701135093201064184630865443835782230 74 × 10^-7428

we obtain:

(((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))-(1.6525126701135093201064184630865443835782230 74 × 10^-7428) -(1.0156731238678143887477757629564691789882352909 8784 × 10^-7427))))))^1/5

Input interpretation:

$$\left(1\Big/\left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.6525126701135093201064184630865443835782230 74}{10^{7428}}-\frac{1.0156731238678143887477757629564691789882352909 8784}{10^{7427}}\right)\right)^{(1/5)}$$

Result:

1.6180339887498948482045868343656381177203091798057628 62135...

1.6180339887498948482045868343656381177203091798057628 62135….

we want to highlight as the non-Gaussianity plays a fundamental role in determining the final PBH abundance and is mathematically connected also to the golden ratio value

Possible closed forms:

$\phi \approx 1.6180339887498948482045868343656381177203091798057628621544862$

$\Phi + 1 \approx 1.6180339887498948482045868343656381177203091798057628621544862$

$\frac{1}{\Phi} \approx 1.6180339887498948482045868343656381177203091798057628621544862$

ϕ is the golden ratio

Φ is the golden ratio conjugate

Instead, for the value

$1.042908427877424818569361856530176016929866483 \times 10^{-7207}$

We obtain:

(((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))-(1.042908427877424818569361856530176016929866483 × 10^-7207) -(1.015673123867814388747775762956469178988235290987 84 × 10^-7427))))))^1/5

Input interpretation:

$$\left(1 \Big/ \left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.042908427877424818569361856530176016929866483}{10^{7207}}-\frac{1.015673123867814388747775762956469178988235290987 84}{10^{7427}}\right)\right)\wedge(1/5)$$

Result:

1.6180339887498948482045868343656381177203091798057628621 35...

1.61803398…. always the golden ratio value

Possible closed forms:

$\phi \approx 1.6180339887498948482045868343656381177203091798057628621354486 2$

$\Phi + 1 \approx 1.6180339887498948482045868343656381177203091798057628621354486 2$

$\frac{1}{\Phi} \approx 1.6180339887498948482045868343656381177203091798057628621354486 2$

Thence, with the our first value, the expression is:

$$\sqrt[5]{\left(\frac{1}{\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}} - \frac{\exp\left(-1.6\left(\frac{1}{2}\left(12\,e^{5/2}\right)^2\right)\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} - \frac{5\sqrt{5}\times 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}}{2\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)} \right)}$$

But we have seen that:

$$P_1(\zeta_R > \zeta_c) = \frac{e^{-\nu^2/2}}{\sqrt{2\pi\nu^2}} \xrightarrow{\zeta_c = 1/3} P_{\rm NG}(\zeta_R > \zeta_c) \simeq \frac{e^{-1.6\,\nu^2/2}}{\sqrt{2\pi\nu^2}}$$

$$P_{\rm NG}(\zeta_R > \zeta_c) \simeq \frac{e^{-1.6\,\nu^2/2}}{\sqrt{2\pi\nu^2}}$$

that is the second term within the above 5th root

$$\left(P_{\mathrm{NG}}(\zeta_R > \zeta_c) \simeq \frac{e^{-1.6\nu^2/2}}{\sqrt{2\pi\nu^2}} \right) =$$

$= 1.652512670113509320106418463086544383578223074 \times 10^{-7428}$

Thence:

$$\sqrt[5]{\left(\frac{1}{\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}} - \frac{e^{-1.6\nu^2/2}}{\sqrt{2\pi\nu^2}} - \frac{5\sqrt{5}\times 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}}{2\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)} \right)} =$$

$$\sqrt[5]{\left(\frac{1}{\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}} - \frac{\exp\left(-1.6\left(\frac{1}{2}\left(12\,e^{5/2}\right)^2\right)\right)}{\sqrt{2\,\pi\left(12\,e^{5/2}\right)^2}} - \frac{5\sqrt{5}\times 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}}{2\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)} \right)} =$$

$= 1.618033988749894848204586834365638117720309179805762862135\ldots = \phi$

Note that

$$\left(P_{\mathrm{NG}}(\zeta_R > \zeta_c) \simeq \frac{e^{-1.6\nu^2/2}}{\sqrt{2\pi\nu^2}} \right) =$$

$= 1.652512670113509320106418463086544383578223074 \times 10\text{^-}7428$

is also equal to:

[(-5.5108856987945862719117799833053880462411461 38×10^-7422)((((((1.61803398)^5- (((((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5))) - (1.015673123867814388747775762 9 × 10^-7427))))))))))))))

Input interpretation:

$$-\frac{5.5108856987945862719117799833053880462411461 38}{10^{7422}}\left(1.61803398^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.0156731238678143887477757629}{10^{7427}}}\right)$$

Result:

$1.652512670113509320106418463086544383578223074\ldots \times 10^{-7428}$

1.652512670113509320106418463086544383578223074 × 10^-7428

Series representations:

$$\frac{1}{10^{7422}}\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.015673123867814388747775762 90000}{10^{7427}}}\right)$$

$$(-1)\,5.5108856987945862719117799833053880462411461380000 = -6.111665728769788\times 10^{-7421}+5.5108856987945862719117799833053880462411461380000\times 10^{-7422}\Big/\left(-1.015673123867814388747775762 90000\times 10^{-7427}+5\,e^{-\pi^5\sqrt{4}^5\left(\sum_{k=0}^{\infty}4^{-k}\binom{1/2}{k}\right)^5}+\frac{1}{32}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)^5\right)$$

$$\frac{1}{10^{7422}}\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.01567312386781438874777576290000}{10^{7427}}}\right)$$

$$(-1)\,5.51088569879458627191177998330538804624114613800000 = -6.111665728769788\times10^{-7421}+5.51088569879458627191177998330538804624114613800000\times10^{-7422}\Big/\left(-1.01567312386781438874777576290000\times10^{-7427}+5\exp\left(-\pi^5\sqrt{4}^5\left(\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)^5\right)+\frac{1}{32}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)^5\right)$$

$$\frac{1}{10^{7422}}\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.01567312386781438874777576290000}{10^{7427}}}\right)$$

$$(-1)\,5.51088569879458627191177998330538804624114613800000 = -6.111665728769788\times10^{-7421}+5.51088569879458627191177998330538804624114613800000\times10^{-7422}\Big/$$

$$\left(-1.01567312386781438874777576290000\times10^{-7427}+5\exp\left(-\frac{\pi^5\left(\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j}4^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)\right)^5}{32\sqrt{\pi}^5}\right)+\frac{1}{32}\left(-1+\frac{\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j}4^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)^5\right)$$

We also observe that:

[(-5.5108856987945862719117799833053880462411461380000×10^-7422)((((((1.61803398)^5- (((((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5))) - (1.015673123867814388 × 10^-7427))))))))))))))*10^7428

Input interpretation:

$$-\frac{5.5108856987945862719117790000}{10^{7422}}\left(1.61803398^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.0156731238678143880000}{10^{7427}}}\right)\times 10^{7428}$$

Result:

1.652512670113509320106418168229292546052479233339508173664...

1.6525126701135….. non-Gaussianity that is mathematically connected also to the result very near to the 14th root of the following Ramanujan's class invariant $Q=\left(G_{505}/G_{101/5}\right)^3$ = 1164.2696 i.e. 1.65578...

Series representations:

$$\frac{1}{10^{7422}}\left(\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.0156731238678143880000}{10^{7427}}}\right)10^{7428}\right)$$

$$(-1)\,5.5108856987945862719117790000=$$

$$-6.11167\times 10^7+5.5108856987945862719117790000\times 10^6\Big/$$

$$\left(-1.0156731238678143880000\times 10^{-7427}+\right.$$

$$\left.5\,e^{-\pi^5\sqrt{4}^5\left(\sum_{k=0}^{\infty}4^{-k}\binom{1/2}{k}\right)^5}+\frac{1}{32}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)^5\right)$$

$$\frac{1}{10^{7422}}\left(\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.0156731238678143880000}{10^{7427}}}\right)10^{7428}\right)$$

$$(-1)\,5.5108856987945862719117790000=$$

$$-6.11167\times 10^7+5.5108856987945862719117790000\times 10^6\Big/$$

$$\left(-1.0156731238678143880000\times 10^{-7427}+\right.$$

$$\left.5\exp\left(-\pi^5\sqrt{4}^5\left(\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)^5\right)+\frac{1}{32}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)^5\right)$$

$$\frac{1}{10^{7422}}\left(\left(1.61803^5-\frac{1}{\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-\frac{1.0156731238678143880000}{10^{7427}}}\right)10^{7428}\right)$$

$$(-1)\,5.5108856987945862719117790000 =$$

$$-6.11167\times10^7+5.5108856987945862719117790000\times10^6\Big/$$

$$\left(-1.0156731238678143880000\times10^{-7427}+\right.$$

$$5\exp\left(-\frac{\pi^5\left(\sum_{j=0}^{\infty}\mathrm{Res}_{s=-\frac{1}{2}+j}\,4^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)\right)^5}{32\sqrt{\pi}^{\,5}}\right)+$$

$$\left.\frac{1}{32}\left(-1+\frac{\sum_{j=0}^{\infty}\mathrm{Res}_{s=-\frac{1}{2}+j}\,4^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)^5\right)$$

Or also

exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)

Input:

$$\frac{\exp\left(-1.6\times\frac{12^2}{2}\right)}{\sqrt{2\,\pi\times12^2}}$$

Result:

$3.09745\ldots\times10^{-52}$

3.09745…*10^-52

More digits

$3.097451425932704989984362207094056409115346651075966 8\ldots\times10^{-52}$

3.0974514259327049899843622070940564091153466510 × 10^-52

3.09745…*10^-52

Series representations:

$$\frac{\exp\left(\frac{1}{2}(-1.6)\,12^2\right)}{\sqrt{2\pi\,12^2}} = \frac{\exp(-115.2)}{\sqrt{-1+288\pi}\sum_{k=0}^{\infty}(-1+288\pi)^{-k}\binom{\frac{1}{2}}{k}}$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\,12^2\right)}{\sqrt{2\pi\,12^2}} = \frac{\exp(-115.2)}{\sqrt{-1+288\pi}\sum_{k=0}^{\infty}\frac{(-1)^k(-1+288\pi)^{-k}\left(-\frac{1}{2}\right)_k}{k!}}$$

$$\frac{\exp\left(\frac{1}{2}(-1.6)\,12^2\right)}{\sqrt{2\pi\,12^2}} = \frac{\exp(-115.2)}{\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(288\pi-z_0)^k z_0^{-k}}{k!}}$$

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

(((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5)))-(3.097451425932704989984362207094056409115346651075966 8× 10^-52) -(1.01567312386781438874777576295646917898823529098784 × 10^-7427))))))^1/5

Input interpretation:

$$\left(1\Big/\left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5+5\,e^{\left(-\sqrt{5}\,\pi\right)^5}\right)-3.097451425932704989984362207094056409115346651075966 8\times 10^{-52}-\frac{1.01567312386781438874777576295646917898823529098784}{10^{7427}}\right)\right)\text{^}(1/5)$$

Result:

1.6180339887498948482045868343656381177203091798057639737 65...

1.61803398…… result that is equal to the value of the golden ratio

1.618033988749...

Possible closed forms:

$\phi \approx 1.6180339887498948482045868343656381177203091798057628621$

$\Phi + 1 \approx 1.6180339887498948482045868343656381177203091798057628621$

$\frac{1}{\Phi} \approx 1.6180339887498948482045868343656381177203091798057628621$

All 5th roots of 11.090169943749474241022934171828190588601545899028852406811362419916046196240700956534800590591324356464:

$1.6180339887498948482045868343656381177203091798057639737656609217268220921006412562243237107048782090291\, e^{0} \approx 1.6180$ (real, principal root)

$1.6180339887498948482045868343656381177203091798057639737656609217268220921006412562243237107048782090291\, e^{(2i\pi)/5} \approx 0.50000 + 1.5388\, i$

$1.6180339887498948482045868343656381177203091798057639737656609217268220921006412562243237107048782090291\, e^{(4i\pi)/5} \approx -1.3090 + 0.95106\, i$

$1.6180339887498948482045868343656381177203091798057639737656609217268220921006412562243237107048782090291\, e^{-(4i\pi)/5} \approx -1.3090 - 0.95106\, i$

$1.6180339887498948482045868343656381177203091798057639737656609217268220921006412562243237107048782090291\, e^{-(2i\pi)/5} \approx 0.50000 - 1.5388\, i$

We have:

((((((1/(((1/32(-1+sqrt(5))^5+5*(e^((-sqrt(5)*Pi))^5))) - (1.01567312386781438874777576295646917898823529098784 × 10^-7427))))))^1/5 - 1.61803398))*3.53999e-44

Input interpretation:

$$\left(\left(1 \Big/ \left(\left(\frac{1}{32}\left(-1+\sqrt{5}\right)^5 + 5\, e^{\left(-\sqrt{5}\,\pi\right)^5}\right) - \frac{1.01567312386781438874777576295646917898823529098784}{10^{7427}}\right)\right)\right)^{(1/5)} - 1.61803398\Bigg) \times 3.53999 \times 10^{-44}$$

Result:

$3.09745\ldots \times 10^{-52}$

More digits

$3.097454026369575534778601528034871729342060247433086 6\ldots \times 10^{-52}$

$3.09745\ldots \times 10^{-52}$

For the previous expression:

$\nu \gg 1. = 144$

e^(-1.6*144^2*1/2)/((2Pi*144^2)^0.5)

$$\frac{e^{-1.6\times 144^2\times 1/2}}{\sqrt{2\pi\times 144^2}}$$

$1.042908427877424818569361856530176016929866483781 73\ldots \times 10^{-7207}$

$1.042908427877\ldots *10^{-7207}$

we obtain, after some calculation:

2(64*1/2*sqrt((colog[e^(-1.6*144^2*1/2)/((2Pi*144^2)^0.5)]))-26-1/4)

Input:

$$2\left(64\times\frac{1}{2}\sqrt{-\log\left(\frac{e^{-1.6\times 144^2\times 1/2}}{\sqrt{2\pi\times 144^2}}\right)}-26-\frac{1}{4}\right)$$

$\log(x)$ is the natural logarithm

Result:

8192.00...

$8192 = 2*64^2$

Alternative representations:

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=2\left(-26-\frac{1}{4}+32\sqrt{-\log_e\left(\frac{e^{-0.8\times 144^2}}{\sqrt{2\,\pi\,144^2}}\right)}\right)$$

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=2\left(-26-\frac{1}{4}+32\sqrt{-\log(a)\log_a\left(\frac{e^{-0.8\times 144^2}}{\sqrt{2\,\pi\,144^2}}\right)}\right)$$

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=2\left(-26-\frac{1}{4}+32\sqrt{\mathrm{Li}_1\left(1-\frac{e^{-0.8\times 144^2}}{\sqrt{2\,\pi\,144^2}}\right)}\right)$$

Series representations:

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=$$
$$-\frac{105}{2}+64\sqrt{\sum_{k=1}^{\infty}\frac{(-1)^k\left(-1+\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}\right)^k}{k}}$$

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=-\frac{105}{2}+$$
$$64\sqrt{-1-\log\left(\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}\right)}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(-1-\log\left(\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}\right)\right)^{-k}$$

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=$$
$$-\frac{105}{2}+64\sqrt{-1-\log\left(\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}\right)}$$
$$\sum_{k=0}^{\infty}\frac{(-1)^k\left(-1-\log\left(\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}\right)\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

Integral representation:

$$2\left(\frac{64}{2}\sqrt{-\log\left(\frac{e^{1/2\,(-1.6)\,144^2}}{\sqrt{2\,\pi\,144^2}}\right)}-26-\frac{1}{4}\right)=-\frac{105}{2}+64\sqrt{-\int_1^{\frac{1}{144\sqrt{2}\;e^{16588.8\sqrt{\pi}}}}\frac{1}{t}\,dt}$$

While, from the expression

exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)

$$\frac{\exp\left(-1.6\times\frac{12^2}{2}\right)}{\sqrt{2\pi\times12^2}}$$

$3.09745\ldots\times10^{-52}$

3.09745…*10^{-52}

We obtain, after some calculation:

1/3*(((colog((exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2))))))^1/3

Input:

$$\frac{1}{3}\sqrt[3]{-\log\left(\frac{\exp\left(-1.6\times\frac{12^2}{2}\right)}{\sqrt{2\pi\times12^2}}\right)}$$

$\log(x)$ is the natural logarithm

Result:

1.63774…

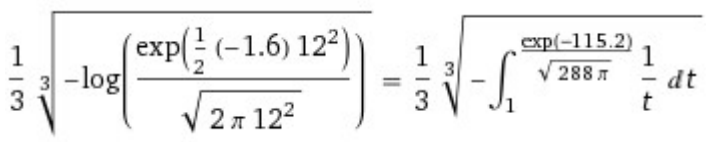
1.63774….≈ $\zeta(2)=\frac{\pi^2}{6}=1.644934\ldots$

Alternative representations:

$$\frac{1}{3}\sqrt[3]{-\log\left(\frac{\exp\left(\frac{1}{2}(-1.6)\,12^2\right)}{\sqrt{2\pi\,12^2}}\right)}=\frac{1}{3}\sqrt[3]{-\log_e\left(\frac{\exp(-0.8\times12^2)}{\sqrt{2\pi\,12^2}}\right)}$$

$$\frac{1}{3}\sqrt[3]{-\log\left(\frac{\exp\left(\frac{1}{2}(-1.6)\,12^2\right)}{\sqrt{2\pi\,12^2}}\right)}=\frac{1}{3}\sqrt[3]{-\log(a)\log_a\left(\frac{\exp(-0.8\times12^2)}{\sqrt{2\pi\,12^2}}\right)}$$

Integral representation:

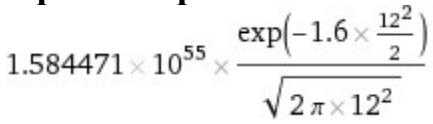


Now, we obtain also:

1.584471*10^55((exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)))

Where 1.584471×10^{55} W/m·K is the value of the thermal conductivity of Planck

Input interpretation:



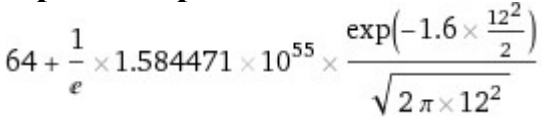
Result:

4907.82…

4907.82…

64+1/e*1.584471*10^55((exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)))

Input interpretation:



Result:

1869.49…

1869.49…. result practically equal to the value of rest mass of D meson 1869.62

From which:

1869.49-[1/e*1.584471*10^55((exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)))]

Input interpretation:

$$1869.49 - \frac{1}{e} \times 1.584471 \times 10^{55} \times \frac{\exp\left(-1.6 \times \frac{12^2}{2}\right)}{\sqrt{2\pi \times 12^2}}$$

Result:

64.0032...

64.0032…. ≈ 64 = 8^2

2*(((1869.49-[1/e*1.584471*10^55((exp(-1.6*(12)^2/2) / sqrt(2Pi*(12)^2)))]))^2-4/5

Input interpretation:

$$2\left(1869.49 - \frac{1}{e} \times 1.584471 \times 10^{55} \times \frac{\exp\left(-1.6 \times \frac{12^2}{2}\right)}{\sqrt{2\pi \times 12^2}}\right)^2 - \frac{4}{5}$$

Result:

8192.02...

8192.02…. result that is connected to the group SO(8192) in the bosonic string and equal to 2*64^2

Furthermore we have also:

$$3\frac{\nu^3}{\sigma^3_{R_H}} W_{R_H}(k) P_\zeta(k) \int \frac{d^3q}{(2\pi)^3} W_{R_H}(q) P_\zeta(q) W_{R_H}(|\vec{q}+\vec{k}|) \left[\frac{P_\zeta(|\vec{q}+\vec{k}|)}{P_\zeta(k)} + 2\right] \approx 6\frac{\nu^3}{\sigma^3_{R_H}} \sigma^2_{R_H} W_{R_H}(k) P_\zeta(k)$$
$$= 6\zeta_c \frac{\nu^2}{\sigma^2_{R_H}} W_{R_H}(k) P_\zeta(k),$$

For:

$$\nu \gg 1. = 144$$

$$\zeta_c \simeq 1/3, \ \sigma_{R_H} \gtrsim 0.036,$$

$$A^2(k_*) = 10^{-2}$$

$$P_\zeta(k) = (2\pi^2/k^3) A^2(k_*) \text{ for } k > k_*$$

[2]Had we used a volume-normalised Gaussian window function $W(k, R_H) = \exp(-k^2 R_H^2/2)$ and a spiky power spectrum of the form $P_\zeta(k) \simeq (A^2/k^3)\delta(\ln k/k_*)$ peaked around the wavenumber k_* and with amplitude A^2, we would have obtained $S_3 \simeq 9 \cdot \sinh(k_*^2 R_H^2)/(k_* R_H)^2$, which differs at $R_H = 1/k_*$ from the result (4.7) only by a

$S_3 = 3$ for r = 1

$$S_3 \simeq 9 \cdot \sinh(k_*^2 R_H^2)/(k_* R_H)^2$$

9*sinh(x^2)/(x)^2 = 3

Input:

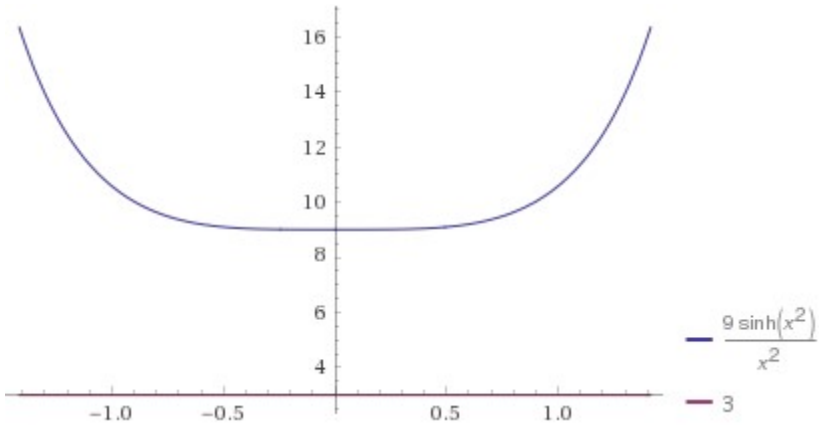
$$9 \times \frac{\sinh(x^2)}{x^2} = 3$$

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

Result:

$$\frac{9 \sinh(x^2)}{x^2} = 3$$

Plot:



Alternate form assuming x is real:

$$x = \frac{3 \sinh(x^2)}{x}$$

Alternate form:

$$\frac{9\, e^{x^2}}{2\, x^2} - \frac{9\, e^{-x^2}}{2\, x^2} = 3$$

Alternate form assuming x is positive:

$x^2 = 3\sinh(x^2)$ (for $x \neq 0$)

Numerical solutions:

$x \approx -1.06744 - 1.06744\,i...$
$x \approx -1.06744 + 1.06744\,i...$
$x \approx 1.06744 - 1.06744\,i...$
$x \approx 1.06744 + 1.06744\,i...$

Input interpretation:

$1.06744 + i \times (-1.06744)$

i is the imaginary unit

Result:

1.06744... −
1.06744... i

Polar coordinates:

$r = 1.50959$ (radius), $\theta = -45°$ (angle)

1.50959

$$W(k, R_H) = \exp(-k^2 R_H^2/2)$$

exp(-1.50959^2/2)

Input interpretation:

$$\exp\left(-\frac{1.50959^2}{2}\right)$$

Result:

0.320001...

0.320001…

From

$$P_\zeta(k) = (2\pi^2/k^3)A^2(k_*) \text{ for } k > k_*$$

for k = 2, we obtain:

(2Pi^2) / (8) * 10^(-2)

Input:

$$\frac{\frac{1}{8}(2\pi^2)}{10^2}$$

Result:

$$\frac{\pi^2}{400}$$

Decimal approximation:

0.024674011002723396547086227499690377838284248518101976566...

0.024674011….

Property:

$\frac{\pi^2}{400}$ is a transcendental number

Alternative representations:

$$\frac{2\pi^2}{10^2 \times 8} = \frac{2(180°)^2}{8 \times 10^2}$$

$$\frac{2\pi^2}{10^2 \times 8} = \frac{2(-i\log(-1))^2}{8 \times 10^2}$$

$$\frac{2\pi^2}{10^2 \times 8} = \frac{12\zeta(2)}{8 \times 10^2}$$

Series representations:

$$\frac{2\pi^2}{10^2 \times 8} = \frac{3}{200}\sum_{k=1}^{\infty}\frac{1}{k^2}$$

$$\frac{2\pi^2}{10^2 \times 8} = -\frac{3}{100}\sum_{k=1}^{\infty}\frac{(-1)^k}{k^2}$$

$$\frac{2\pi^2}{10^2 \times 8} = \frac{1}{50}\sum_{k=0}^{\infty}\frac{1}{(1+2k)^2}$$

Integral representations:

$$\frac{2\pi^2}{10^2 \times 8} = \frac{1}{25}\left(\int_0^1 \sqrt{1-t^2}\,dt\right)^2$$

$$\frac{2\pi^2}{10^2 \times 8} = \frac{1}{100}\left(\int_0^{\infty}\frac{1}{1+t^2}\,dt\right)^2$$

$$\frac{2\pi^2}{10^2 \times 8} = \frac{1}{100}\left(\int_0^1 \frac{1}{\sqrt{1-t^2}}\,dt\right)^2$$

This is not at all an insignificant effect for $\nu \gg 1$. For instance one can ask what is the impact on the PBH abundance at formation. We follow Ref. [32] and we set $\beta_{\rm prim}(M)$ such that it corresponds today to a totality of the dark matter in the form of PBHs. Choosing $\zeta_c \simeq 1/3$, a Gaussian probability would give $\sigma_{R_H} \gtrsim 0.036$, while the non-Gaussian result (4.14) would deliver a result smaller than about ten orders of magnitude. This shows the large sensitivity of the non-Gaussian result to the cosmological observables. Of course, this is not the final result as there are other contributions to the cumulants we have not accounted for. For instance, S_4 receives a connected contribution from the correlator $\langle\zeta_1(\vec{x})\zeta_1(\vec{x})\zeta_1^2(\vec{x})\zeta_1^2(\vec{x})\rangle$. We have not been able to resum all the pieces. Despite their incompleteness and the fact that the details have to be worked out model by model, our findings indicate that non-Gaussianity plays a fundamental role in determining the final PBH abundance.

From:

$$6\,\zeta_c\frac{\nu^2}{\sigma^2_{R_H}}W_{R_H}(k)P_\zeta(k),$$

For:

0.024674011 ; 0.320001 ;

$\nu \gg 1. = 144$

$\zeta_c \simeq 1/3,\ \sigma_{R_H} \gtrsim 0.036,$

$= 0.037$

we obtain:

6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674

Input:

$$6 \times \frac{1}{3} \times \frac{144^2}{0.037^2} \times 0.32 \times 0.024674$$

Result:

239188.926924762600438276113951789627465303140978816654492 3...

239188.926924…

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

sqrt(golden ratio) * exp(Pi*sqrt(n/15)) / (2*5^(1/4)*sqrt(n)) for n = 401 , we obtain:

sqrt(golden ratio) * exp(Pi*sqrt(401/15)) / (2*5^(1/4)*sqrt(401))-1535-21

where 1535 is the rest mass of Xi baryon and 21 is a Fibonacci number

Input:

$$\sqrt{\phi} \times \frac{\exp\left(\pi \sqrt{\frac{401}{15}}\right)}{2 \sqrt[4]{5}\ \sqrt{401}} - 1535 - 21$$

ϕ is the golden ratio

Exact result:

$$\frac{e^{\sqrt{401/15}\ \pi} \sqrt{\frac{\phi}{401}}}{2 \sqrt[4]{5}} - 1556$$

Decimal approximation:

239190.424728179021573760146125852822153608140541668858986 6...

239190.4247….

Property:

$$-1556+\frac{e^{\sqrt{401/15}\,\pi}\sqrt{\frac{\phi}{401}}}{2\sqrt[4]{5}}$$ is a transcendental number

Alternate forms:

$$\frac{1}{2}\sqrt{\frac{5+\sqrt{5}}{4010}}\;e^{\sqrt{401/15}\,\pi}-1556$$

$$\frac{\sqrt{\frac{1}{802}\left(1+\sqrt{5}\right)}\;e^{\sqrt{401/15}\,\pi}}{2\sqrt[4]{5}}-1556$$

$$\frac{5^{3/4}\sqrt{802\left(1+\sqrt{5}\right)}\;e^{\sqrt{401/15}\,\pi}-12\,479\,120}{8020}$$

Series representations:

$$\frac{\sqrt{\phi}\,\exp\left(\pi\sqrt{\frac{401}{15}}\right)}{2\sqrt[4]{5}\,\sqrt{401}}-1535-21=\left(-15\,560\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(401-z_0)^k\,z_0^{-k}}{k!}+5^{3/4}\right.$$
$$\left.\exp\left(\pi\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{401}{15}-z_0\right)^k z_0^{-k}}{k!}\right)\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(\phi-z_0)^k\,z_0^{-k}}{k!}\right)\Big/$$
$$\left(10\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k(401-z_0)^k\,z_0^{-k}}{k!}\right)\quad\text{for}\ (\text{not}\ (z_0\in\mathbb{R}\ \text{and}\ -\infty<z_0\le 0))$$

$$\frac{\sqrt{\phi}\ \exp\left(\pi\sqrt{\frac{401}{15}}\right)}{2\sqrt[4]{5}\ \sqrt{401}} - 1535 - 21 =$$
$$\left(-15560\exp\left(i\pi\left\lfloor\frac{\arg(401-x)}{2\pi}\right\rfloor\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(401-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!} + 5^{3/4}\exp\left(i\pi\left\lfloor\frac{\arg(\phi-x)}{2\pi}\right\rfloor\right)\exp\left(\pi\exp\left(i\pi\left\lfloor\frac{\arg\left(\frac{401}{15}-x\right)}{2\pi}\right\rfloor\right)\sqrt{x}\right.\right.$$
$$\left.\left.\sum_{k=0}^{\infty}\frac{(-1)^k\left(\frac{401}{15}-x\right)^k x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(\phi-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\Big/$$
$$\left(10\exp\left(i\pi\left\lfloor\frac{\arg(401-x)}{2\pi}\right\rfloor\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(401-x)^k\,x^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right) \quad \text{for } (x\in\mathbb{R} \text{ and } x<0)$$

$$\frac{\sqrt{\phi}\ \exp\left(\pi\sqrt{\frac{401}{15}}\right)}{2\sqrt[4]{5}\ \sqrt{401}} - 1535 - 21 =$$
$$\left(\left(\frac{1}{z_0}\right)^{-1/2\,\lfloor\arg(401-z_0)/(2\pi)\rfloor} z_0^{-1/2\,\lfloor\arg(401-z_0)/(2\pi)\rfloor}\left(-15560\left(\frac{1}{z_0}\right)^{1/2\,\lfloor\arg(401-z_0)/(2\pi)\rfloor}\right.\right.$$
$$z_0^{1/2\,\lfloor\arg(401-z_0)/(2\pi)\rfloor}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(401-z_0)^k\,z_0^{-k}}{k!} +$$
$$5^{3/4}\exp\left(\pi\left(\frac{1}{z_0}\right)^{1/2\left\lfloor\arg\left(\frac{401}{15}-z_0\right)/(2\pi)\right\rfloor} z_0^{1/2\left(1+\left\lfloor\arg\left(\frac{401}{15}-z_0\right)/(2\pi)\right\rfloor\right)}\right.$$
$$\left.\left.\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(\frac{401}{15}-z_0\right)^k z_0^{-k}}{k!}\right)\left(\frac{1}{z_0}\right)^{1/2\,\lfloor\arg(\phi-z_0)/(2\pi)\rfloor}\right.$$
$$\left.z_0^{1/2\,\lfloor\arg(\phi-z_0)/(2\pi)\rfloor}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(\phi-z_0)^k\,z_0^{-k}}{k!}\right)\Big/$$
$$\left(10\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\,(401-z_0)^k\,z_0^{-k}}{k!}\right)$$

Thence:

$$3\frac{\nu^3}{\sigma^3_{R_H}} W_{R_H}(k) P_\zeta(k) \int \frac{\mathrm{d}^3 q}{(2\pi)^3}\, W_{R_H}(q)\, P_\zeta(q)\, W_{R_H}(|\vec{q}+\vec{k}|) \left[\frac{P_\zeta(|\vec{q}+\vec{k}|)}{P_\zeta(k)} + 2\right] \approx 6\frac{\nu^3}{\sigma^3_{R_H}} \sigma^2_{R_H} W_{R_H}(k) P_\zeta(k)$$
$$= 6\,\zeta_c \frac{\nu^2}{\sigma^2_{R_H}} W_{R_H}(k) P_\zeta(k),$$

= 239188.9269…

2+(((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674)))^1/3

Input:

$$2 + \sqrt[3]{6 \times \frac{1}{3} \times \frac{144^2}{0.037^2} \times 0.32 \times 0.024674}$$

Result:

64.0746…

64.0746… ≈ 64 = 8^2

2*[(((2+(((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674)))^1/3)))^2-8-3/2]

Input:

$$2\left(\left(2 + \sqrt[3]{6 \times \frac{1}{3} \times \frac{144^2}{0.037^2} \times 0.32 \times 0.024674}\right)^2 - 8 - \frac{3}{2}\right)$$

Result:

8192.10…

8192.10… ≈ 8192 = 2*64^2

And again:

ln((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674))

Input:

$$\log\left(6 \times \frac{1}{3} \times \frac{144^2}{0.037^2} \times 0.32 \times 0.024674\right)$$

$\log(x)$ is the natural logarithm

Result:

12.3850...

12.3850… result very near to the value of black hole entropies 12.1904 – 12.5664

Alternative representations:

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = \log_e\left(\frac{0.0157914 \times 144^2}{0.037^2}\right)$$

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = \log(a)\log_a\left(\frac{0.0157914 \times 144^2}{0.037^2}\right)$$

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = -\text{Li}_1\left(1 - \frac{0.0157914 \times 144^2}{0.037^2}\right)$$

Series representations:

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = \log(239\,188.) - \sum_{k=1}^{\infty} \frac{(-1)^k\, e^{-12.385\,k}}{k}$$

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = 2\,i\,\pi\left\lfloor \frac{\arg(239\,189. - x)}{2\,\pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(239\,189. - x)^k\, x^{-k}}{k} \quad \text{for } x < 0$$

$$\log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) = \left\lfloor \frac{\arg(239\,189. - z_0)}{2\,\pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(239\,189. - z_0)}{2\,\pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k\,(239\,189. - z_0)^k\, z_0^{-k}}{k}$$

Integral representations:

$$\log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)=\int_1^{239189.}\frac{1}{t}\,dt$$

$$\log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)=\frac{1}{2\,i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{e^{-12.385\,s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds$$

for $-1<\gamma<0$

144*[ln((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674))]-55

Input:

$$144\log\left(6\times\frac{1}{3}\times\frac{144^2}{0.037^2}\times 0.32\times 0.024674\right)-55$$

$\log(x)$ is the natural logarithm

Result:

1728.44...

1728.44…

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

Alternative representations:

$$144\log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55=-55+144\log_e\left(\frac{0.0157914\times 144^2}{0.037^2}\right)$$

$$144\log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55=-55+144\log(a)\log_a\left(\frac{0.0157914\times 144^2}{0.037^2}\right)$$

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 = -55-144\,\text{Li}_1\left(1-\frac{0.0157914\times 144^2}{0.037^2}\right)$$

Series representations:

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 =$$
$$-55+144\log(239\,188.)-144\sum_{k=1}^{\infty}\frac{(-1)^k\,e^{-12.385\,k}}{k}$$

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 = -55+288\,i\,\pi\left\lfloor\frac{\arg(239\,189.-x)}{2\,\pi}\right\rfloor+$$
$$144\log(x)-144\sum_{k=1}^{\infty}\frac{(-1)^k\,(239\,189.-x)^k\,x^{-k}}{k}\quad\text{for } x<0$$

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 =$$
$$-55+144\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+144\log(z_0)+$$
$$144\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log(z_0)-144\sum_{k=1}^{\infty}\frac{(-1)^k\,(239\,189.-z_0)^k\,z_0^{-k}}{k}$$

Integral representations:

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 = -55+144\int_1^{239\,189.}\frac{1}{t}\,dt$$

$$144 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-55 =$$
$$-55+\frac{72}{i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{e^{-12.385\,s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\quad\text{for } -1<\gamma<0$$

12*[ln((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674))]-21-2

Input:

$$12 \log\left(6 \times \frac{1}{3} \times \frac{144^2}{0.037^2} \times 0.32 \times 0.024674\right) - 21 - 2$$

$\log(x)$ is the natural logarithm

Result:

125.620...

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

Alternative representations:

$$12 \log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) - 21 - 2 = -23 + 12 \log_e\left(\frac{0.0157914 \times 144^2}{0.037^2}\right)$$

$$12 \log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) - 21 - 2 = -23 + 12 \log(a) \log_a\left(\frac{0.0157914 \times 144^2}{0.037^2}\right)$$

$$12 \log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) - 21 - 2 = -23 - 12 \operatorname{Li}_1\left(1 - \frac{0.0157914 \times 144^2}{0.037^2}\right)$$

Series representations:

$$12 \log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) - 21 - 2 =$$
$$-23 + 12 \log(239\,188.) - 12 \sum_{k=1}^{\infty} \frac{(-1)^k\, e^{-12.385\,k}}{k}$$

$$12 \log\left(\frac{(6\,(0.32 \times 0.024674))\,144^2}{3 \times 0.037^2}\right) - 21 - 2 = -23 + 24\,i\,\pi \left\lfloor \frac{\arg(239\,189. - x)}{2\,\pi} \right\rfloor +$$
$$12 \log(x) - 12 \sum_{k=1}^{\infty} \frac{(-1)^k\, (239\,189. - x)^k\, x^{-k}}{k} \quad \text{for } x < 0$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-21-2=$$
$$-23+12\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+12\log(z_0)+$$
$$12\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log(z_0)-12\sum_{k=1}^{\infty}\frac{(-1)^k\,(239\,189.-z_0)^k\,z_0^{-k}}{k}$$

Integral representations:

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-21-2=-23+12\int_1^{239189.}\frac{1}{t}\,dt$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-21-2=$$
$$-23+\frac{6}{i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{e^{-12.385\,s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\quad\text{for}\quad -1<\gamma<0$$

12*[ln((6*1/3*(144^2)/(0.037)^2 * 0.32 * 0.024674))]-7-2

Input:

$$12 \log\left(6\times\frac{1}{3}\times\frac{144^2}{0.037^2}\times 0.32\times 0.024674\right)-7-2$$

$\log(x)$ is the natural logarithm

Result:

139.620...

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

Alternative representations:

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9+12\log_e\left(\frac{0.0157914\times 144^2}{0.037^2}\right)$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9+12\log(a)\log_a\left(\frac{0.0157914\times 144^2}{0.037^2}\right)$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9-12\,\mathrm{Li}_1\left(1-\frac{0.0157914\times 144^2}{0.037^2}\right)$$

Series representations:

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=$$
$$-9+12\log(239\,188.)-12\sum_{k=1}^{\infty}\frac{(-1)^k\,e^{-12.385\,k}}{k}$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9+24\,i\,\pi\left\lfloor\frac{\arg(239\,189.-x)}{2\,\pi}\right\rfloor+$$
$$12\log(x)-12\sum_{k=1}^{\infty}\frac{(-1)^k\,(239\,189.-x)^k\,x^{-k}}{k}\quad\text{for } x<0$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9+12\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log\left(\frac{1}{z_0}\right)+$$
$$12\log(z_0)+12\left\lfloor\frac{\arg(239\,189.-z_0)}{2\,\pi}\right\rfloor\log(z_0)-12\sum_{k=1}^{\infty}\frac{(-1)^k\,(239\,189.-z_0)^k\,z_0^{-k}}{k}$$

Integral representations:

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=-9+12\int_1^{239189.}\frac{1}{t}\,dt$$

$$12 \log\left(\frac{(6\,(0.32\times 0.024674))\,144^2}{3\times 0.037^2}\right)-7-2=$$
$$-9+\frac{6}{i\,\pi}\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{e^{-12.385\,s}\,\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds\quad\text{for } -1<\gamma<0$$

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.

References

Primordial Black Holes from Inflation and non-Gaussianity
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