Synchronous Co-ordinates of External and Internal Symmetries in a World Scalar Transform

Mark A. Thomas

Calculations of Scalars are constructed using an equation having exponential suppression going from a high gravitational potential in the flat space towards an extreme exponential low gravitational potential space. The calculation is viable through the use of a surprising identity enabling calculations of ordering of the scalar through near to non-linear curves. The use of the Monster group's symmetry as an invariant is key. Another surprise is that the ordering of the Scalars is directly associated with the 194 x 194 character table of the Monster group and possibly connects the *McKay-Thompson Series* to physics of the natural world. If so this would have implications for the Standard Model, gravity and vacuum energies. As Codata values of NIST are considered to be standard, these are met in the paper except in regard to the gravitational constant *G* which is realigned to acceptable value (very close to Codata).

In this paper are presented several mathematical and physics forms along with hypothetical directions and speculations. A strange logic is applied off an idea of a finite ordering using the Monster group's array of 194 x 194 columns and rows used to describe the mini-functions and haupmoduls, some responsible for the Moonshine phenomena [1.]. As such it describes a huge matrix of which this paper does not address because of limitations in computer power and software utilized. I was determined to make it simple by just using a linear progression from 194 to 1 in order to show the correlation throughout going through a gravitational gradient (aka. flat space to extremal curvature) of high potential to unimaginable extreme low potential. This I believe is achieved in this work. However, I learned that there is no true linear progression in this due to the actor Gravity. As scalars are generated it became evident that a trace diagonal was probably being described. But first, I want to make clear that this does not describe quantum gravity, but is likely a future pathway to such if it has measure of validity. It is a Global non-linear progression of the scalars involved in order to satisfy the invariance element ordering of the Monster group. Its order is probably non-linear due to effects of Relativity although there is some pseudo- linearity in the flat space. It is a hope that the strange logic is a correct application. The physics players are as follows, **1.** the charged pi-meson, **2.** the anti-matter combination of electron-positron, **3.** the strong force isospin and weak isospin (the relation between uud, ddu and ud, du), **4.** A Machian Scalar, **5.** and invariants. Overall the hypothesis may be a thought in the cloud and wrong, but the results are there and they appear to work in a beautiful and elegant way. If valid a surface simplicity is there for some limited understanding even for an undergraduate. This work piggybacks on earlier calculations with an equation that seems to calculate the enormous order of the Monster group [2]. A unique and surprising identity is used and is paramount to all that follows to generate the curves. The claim is that a World Scalar is found within the 194 x 194 array of the character table of the Monster group and that this requires real values of Standard Model (SM) physics particles and a gravitational scalar (conformal) under the Global invariance of the Monster symmetry. The Scalar progression (starting at column 194, row 1) appears to occur in context of the quantum vacuum energies and gravitational scaling. If so the implications are mind boggling and the work lies ahead.

The Equations

The Monster group is a very large symmetry group having a large integer number of elements.

808017424794512875886459904961710757005754368000000000

This integer value is approximately 8×10^{53}. The two following forms are equivalent;

$$16\left(\sqrt[2048]{\frac{1}{\sqrt[65536]{\frac{hc}{2\pi G m_p m_n}\frac{\sqrt{2}\,M_{pl}^2}{\alpha}}-1}}\right)^5 \frac{M_{pl}^2}{m_{e^+e^-}^2}\frac{m_{\pi^{+-}}^2}{m_{e^+e^-}^2}\frac{m_{\pi^{+-}}^2}{m_{e^+e^-}^2} = \text{Ṃ} \qquad (1)$$

$$16\left(\sqrt[2048]{\frac{1}{\sqrt[65536]{2^4\sqrt{\frac{e}{2}}\, e^{\pi/4\alpha}\,\alpha^3\,\frac{\sqrt{2}\,M_{pl}^2}{2}}-1}}\right)^5 \frac{M_{pl}^2}{m_{e^+e^-}^2}\frac{m_{\pi^{+-}}^2}{m_{e^+e^-}^2}\frac{m_{\pi^{+-}}^2}{m_{e^+e^-}^2} = \text{Ṃ} \qquad (2)$$

Where Ṃ = Number of elements of symmetry of the Monster

$$\phi = \left(\sqrt[2048]{\frac{1}{\sqrt[65536]{\frac{hc}{2\pi G m_p m_n}\frac{\sqrt{2}\,M_{pl}^2}{\alpha}}-1}}\right) \qquad (3)$$

Where ϕ is the gravitational scalar.

The calculations only need to follow 8 to 12 significant figures of Ṃ since utilization of Codata 2022 is excellent to near that many significant figures [3]. The exception is Newton's constant which is only good to 6 significant figures and has potential large uncertainty to its precision and accuracy. This will be discussed below as to how this can be addressed which also changes the Planck mass-energy value minimally.

The nomenclature used in the forms is as follows using the 2022 CODATA,

In Codata 2022

$M_{pl} = 2.176434 \times 10^{-8} kg \quad (Planck\ mass)$
$G = 6.67430 \times 10^{-11} \quad (Newton\ constant)$
$h = 6.62607015 \times 10^{-34} \quad (Planck\ constant)$
$c = 299792458\ cm/s \quad (speed\ of\ light\ in\ vacuum)$
$m_{e^+e^-} = 1.82187674278 \times 10^{-30} kg \quad (combined\ mass\ of\ electron\ positron\ pair)$
$m_p = 1.67262192595 \times 10^{-27} kg \quad (proton\ mass)$
$m_n = 1.67492750056 \times 10^{-27} kg \quad (neutron\ mass)$
$\alpha = 0.0072973525643\ (fine\ structure\ constant)$

Outside Codata

$m_{\pi^{+-}} = 2.4880682 \times 10^{-28} kg\ (charged\ pion\ mass)$ translated from 2022 PDG[3] value
$= 139.57039(18)\ MeV/c^2$
$e = 2.718281828 \ldots \quad (Euler's\ number)$

I mention that the *Mathematica* [4.] code is available of these forms at the end of this paper for exploration and also available in an earlier paper [2]. In addition, equation 1. has the proton neutron as a direct product at the bottom of the dimensionless physics form. This is representative of our place in the gravitational near flat space in the Universe. This flavor inclusion works very well but is not used "as is" in the procedure because it will not represent an integer matrix array number. It is actually very close to a number in the array that is a dividing point between the protonic and neutronic spaces in the scalar. This direct product (changes in energies) actually is a double copy that represents the *SU(2) x SU(2)* of strong and weak isospins and these values change in the scalar matrix array number in integer jumps going to higher energy vacuum and gravitational states. Not necessarily that this is a quantization because the scalar action is actually smooth. Hopefully this will become clear.

$$\frac{hc}{\pi G m_p m_n} = 3.38164 \times 10^{38}\ (dimensionless) \qquad \textbf{(4)}$$

$$2\sqrt[4]{\frac{e}{2}}\, e^{\pi/4\alpha}\ \ \alpha^4 = 3.3820238042 \times 10^{38}\ (dimensionless) \qquad \textbf{(5)}$$

These appear to be two disparate relations. The values utilize Codata 2022 with the first being good to 6 significant figures and the second being even better to 11 significant figures. The Newton constant G is the reason for the first as it does not yet have precise and accurate consensus among experimentalist. If it is considered that everything else is out to 8 or more significant figures then, both equations can be set to each other to solve for G.

$$\frac{hc}{\pi\, x m_p m_n} = 2\sqrt[4]{\frac{e}{2}}\, e^{\pi/4\alpha}\ \ \alpha^4 \qquad (\textbf{6})$$

That the fine structure constant on the right side has 11 significant figures, this gives a beautiful control to the solution, especially if it is considered that these parameters exist at the same vacuum energy levels. The value for G is obtained to 9 significant figures, $x = 6.67354204 \times 10^{-11} m^3 kg^{-1} s^{-2}$. This will redefine the Planck mass to be equal to $2.17642551\ 10^{-8}\ kg$. Using the new determined G relations **3** and **4** are thus equal to each other (or appear to $= 3.3820238041 \times 10^{38}\ vs.\ 3.3820238054 \times 10^{38}$). The G and Planck mass values are still very close to the Codata values.

A core calculation to running the vacuum values is as follows;

$$hc/2\pi G x_{nn}^2 = Exp(\pi\sqrt{integer})\ 70^2/2 \qquad (\textbf{7})$$

Placement of an integer value from column 194, row 1 to column 1, row 194 will give increasing vacuum energies of SU(2) x SU(2) starting with 194 or decreasing vacuum values starting with 1. The x_{nn} value is the resulting isospin baryon related to mixing of advancing vacuum energies which this paper will use (i.e. starting at 194). It is noted that the integer value doesn't quite indicate quantization as the movement in time appears to be smooth at finer and finer determinations of energies within the level between two integers (e.g. somewhere in between 194 and 193). At each level of the character table array lie the mini-j functions (*McKay-Thompson Series*) which may have something to do with this. Equation **7** is only a doorway in as it represents one of 5 parameters that will need to be calculated. For the purposes of calculating equation **7** the geometric mean of the value x_{nn} due to direct product is used for computations for establishing the curves. An interesting and surprising result is manifested at 163 which is the famous Heegner number for which will be included below.

The Invariants

Before the calculations are demonstrated it is upmost importance to point out the invariants that are established in the equations.

$M_{pl} = 2.17642551 \times 10^{-8} kg \quad (Planck\ mass)$ as modified from Codata, and eq. **6**

$h/2\pi G = 1.580228027 \times 10^{-24}\ kg^2 s\ m^{-1}$ G as modified from Codata and eq. **6**

$c = 299792458\ cm/s \ \ (speed\ of\ light\ in\ vacuum)$

$\phi\pi_{+-_{nn}} = 140.0522602\ Mev/c$ Gravitational scalar × charged pi-meson mass[1]

Ṃ= $8.0801742479 \times 10^{53}$ truncated integer of Monster group symmetry 11 fig.

$1\ kg$ unitary value in scalar ϕ

The Base Calculation

Using equation **1** with Codata 2022 and modified value of Newton constant G, there is procedure to align the PDG 2022 [6.] of the charged pi-meson $\pi_{\pm-}$ with the Codata 2022 set. Note that the proton and neutron values are a direct product and the fine structure constant is at 11 significant figures.

The following values are obtained;

Setting equation, Ṃ $= 8.0801742479 \times 10^{53}$
Aligned value of pi-meson, $\pi_{\pm-} = 2.488103672 \times 10^{-28} kg = 139.57238006\ MeV/c$ [2]
Scalar $\phi = 1.00343821831265$
Invariant, $\phi\pi_{\pm-} = 140.0522602$

This establishes the invariant $\phi\pi_{\pm-}$ which is used in the calculations in our 2022 Codata universe. For the purposes of this paper the base calculation represents the known vacuum energy and flat space conditions in the Standard Model physics.

The Case for 163

[1] The calculations in the paper use SI units. This trick makes it easy to calculate the charged pi-meson mass which can then be converted to SI units of kg. This invariance holds throughout any changes in vacuum energies. It is possibly related to the false vacuum lightest goldstone value. In addition this coupling is a new symmetry with a possible particle interchange occurring between the gravitational scalar and the pi-meson (strong force).

[2] This value is a little larger than the Codata 2022 value and the PDG 2022 value.

The prime number 163 is a Heegner number. A very interesting and surprising result in equation **7** is that the neutron mass value is calculated on top of the 2022 Codata value for the same when using the readjusted value of the Newton constant *G*. This was not preconceived but unexpected.

$$\frac{hc}{2\pi G x_{nn}^2} = \frac{Exp(\pi\sqrt{163})70^2}{2} = 1.67492740543 \times 10^{-27} kg$$

The constant *G* is readjusted through the other equation **6** which is considered an identity. The Heegner number 163 (famous for its best representation of a near integer via CM) may also be related to the Monster group according to Conway and Norton [5.]. They anticipated that in the 194 min-j-functions found in the character table that as one reduces the redundancies of similar mini-j-functions (Repetitions of the *McKay-Thompson Series*) as one goes down the list from 194 ...171 then 163. The idea for incorporating the 194 x 194 array integers using equation **7** was a doorway into calculating polynomial curves using equations **1** and **2**. Basically, enables to compute the following values very easily and retain the symmetry order of the Monster group throughout ever increasing non-linear gravitational curvature in non-linear evolution from 194 to 1 as a highly probable trace diagonal of a square 194 x 194 matrix. In order of calculation goes,

$m_{pn} or\ m_{nn}\ \ low/current/high\ neutron\ or\ higher\ energy\ plasmas$

$\alpha_{pn}\ or\ \alpha_{nn}\ fine\ structure\ constant\ or\ at\ low/high\ energy\ vacuum\ interaction$

$\phi_{pn}\ or\ \phi_{nn}\ \ gravitational\ scalar\ low/current/\ high\ \ energy$

$\pi_{+\,-_{pn}}\ or\ \pi_{+\,-nn}\ charged\ pion\ or\ at\ low/current\ /high\ energy\ vacuum\ interaction$

$m_{e+e-_{pn}} or\ m_{e+e-nn}\ electron - positron\ pair\ or\ low/high\ energy\ vacuum\ interaction$

All of these parameters are calculated to obtain polynomials that behave under the curvature of the gravitational scalar. As such the scalar is the master for the behavior of the system under the invariance of the Monster group symmetry. If there are indeed redundancies they do lead up to our current state of vacuum energy and flat space and maybe the gravitational gradient which is near to non-linear in our calculations (from high potential to low potential) has something to do with this. Our neighborhood resides in a near flat space that may have a relationship to the functions at 163, 1 in the character table. Why? It is speculative but a Universe with a false vacuum and its lightest Goldstone meson may have stabilized at or near the gravitational and quantum vacuum energies near its cosmological birth. This may sound ridiculous but in theory a Universe could have different values at its birth and still be relevant to 163, 1 in the Monster's character table. The invariant $\phi\pi_{+-_{nn}} = 140.0522602\ Mev/c$ has a symmetry from that which is selective for a Universe being partly explained by a Standard Model particle group. Finally, it should be noted that the particles themselves in this realm may change nature due to extremal gravity, extremal-extremal gravity and finally something like exponential extremal gravity. An example would be the pi-meson mass going to higher vacuum energies and gravitational gradient will obey a negative *beta function.* As it decreases in mass its radius should increase because of *asymptotic freedom*. Eventually mass plasma of near free quarks and or gluons will be the entity. Another consideration is that these are quantum fields best explained by QFT. The particle association is a nice package to deal with.

Solving for the Group Calculation

1.] The integer value for the column, row is simply entered into equation **7** to obtain the value of the hadron mass (from the double copy of *SU(2)*) which is the value at that particular point which is a vev for that vacuum energy. Let's take the starting 194, 1 since it resides at a lower vacuum energy.

$$hc/2\pi G x_{pn}^2 = Exp(\pi\sqrt{194})\, 70^2/2$$

$$x_{pn} = 4.36137648 \times 10^{-29} kg$$

The subscript *pn* refers to lower vacuum energies up to current value of a double copy *SU(2)* of the isospin relation of the proton to the neutron. After the table value for 163 this designation will change to higher energy values as subscript *nn* such that x_{nn}.

2.] The next value in order to obtain is the fine structure constant using identities equation **6**.

$$\frac{hc}{\pi G\,(4.36137648\ 10^{-29} kg)^2} = 2\sqrt[4]{\frac{e}{2}}\, e^{\pi/4\alpha_{pn}}\ \alpha_{pn}{}^4$$

$$\alpha_{pn} = 0.0068180166\ \ dimensionless$$

3.] Then solve for the scalar ϕ_{pn} using equation **3**,

$$\phi_{pn} = \left(\sqrt[2048]{\frac{1}{\sqrt[65536]{\frac{hc\ \ \sqrt{2}\ M_{pl}^2}{2\pi G\left(4.36137648\ 10^{-29}\right)^2\ \ 0.0068180166}} - 1}}\right)$$

We use the other parameters as the invariants as stated earlier.

$$\phi_{pn} = 1.0033796409\ \ dimensionless$$

4.] Using the invariant $\phi\pi_{+-_{pn}} = 140.0522602\ Mev/c$ we can determine the higher value of the charged pi-meson mass at this particular weaker energy level.

$$\phi\pi_{+-_{pn}} \div \phi_{pn} = 139.5805283\ MeV/c$$

$$139.5805283\ MeV/c \quad \text{Converts to SI units} \quad 2.488248928 \times 10^{-29} kg$$

$$\pi_{+-_{pn}} = 2.488248928 \times 10^{-29} kg$$

5.] This is the final calculation for the group set to obtain the electron- positron mass at the level of the array at 194, 1. From the remaining part of equation **1**, we only need 8 or 9 figures due to significant figures available.

$$16\ (1.0033796409)^5\ \frac{M_{pl}^2}{x_{e+e-pn}^2}\ \frac{(2.488248928{\times}10^{-29}kg)^2}{x_{e+-pn}^2}\ \frac{(2.488248928{\times}10^{-29}kg)^2}{x_{e+\,-pn}^2}$$

$$= 8.0801742479 \times 10^{53}$$

$$x_{e+-_{pn}} = m_{e+-_{pn}} = 1.821859016 \times 10^{-30} kg$$

This completes a set group which will be used to form a mini-dataset for the gravitational potential and vacuum energy level at 194, 1.

The Mini-Databases and Generated Curves

This section will present the databases that have been calculated to generate polynomial snippets (explanation below). There are 5 mini-databases each representing a generated polynomial curve using *Mathematica* coding [3.]. The data for each mini-database is from a group set using the method above to obtain 5 physics parameters for each integer represented in the column, row array of the 194 x 194 character table. These databases are short because of the limitations of using non-integer parameters in the *Mathematica* algorithm output. Each mini-database contains only 7 input strings per integer number group set which consist of 5 calculated parameters. Hopefully this becomes apparent. Since there are limitations to the efficacy of the programming using these parameters there are only 5 short string sets of the mini-databases representing areas of the array to capture what is possibly going on overall. There are limitations to the generated polynomials with most being of degree 6 (sextic). That these are only approximations will be discussed. First we will start with the integer group 194, 193, 192, 191, 190, 189, 188. This is where the vacuum energies and gravitation is the weakest. We skip a portion and go with the integer group 166, 165, 164, 163, 162, 161, 160 where our current physics hover around the 163, 1. Next we skip some more to examine the integer group 100, 99, 98, 97, 96, 95, 94. All the while the vacuum energies and gravitation continue climbing. This is the middle of the array at 97. Up to this dataset sector 3 the normal *beta function* seems to be obeyed. At the integer group 14, 13, 12, 11, 10, 9, 8 there are inflection points where some parameters change direction in mass values with gravitational scalar decreasing at some probable inflection points. *The beta function* changes sign for some of the parameters. Finally the bookending is finished with the integer group 7, 6, 5, 4, 3, 2, 1 with noted changes. The implication is non-linearity at this area changes the gravitational strength (decreases) where the *pi-meson* mass starts to increase. The last two groups are at gravitational curvatures beyond anything related to something like a *neutron star*. At this end the gravitational curvatures are at exponential extremal-extremal for lack of imagination. The gravitational scalar starts to decrease.

The Case of Beginning at 194

We begin the array integer where the gravitational energies and vacuum energies are the weakest. The polynomials appear for the most part to be almost linear but are actually non-linear. The exception to this for all data bases throughout the array is the hadron mass in the *SU(2) x SU(2)* group which exhibits an apparent curve. Each database follows the order of calculation that was offered above followed by its graph.

Dataset Sector 1 from 194, 193, 192, 191, 190, 189, 188

Curve {4.36138×10^-29, 4.88276×10^-29, 5.46807×10^-29, 6.12535×10^-29, 6.86368×10^-29, 7.69331×10^-29, 8.62583×10^-29}

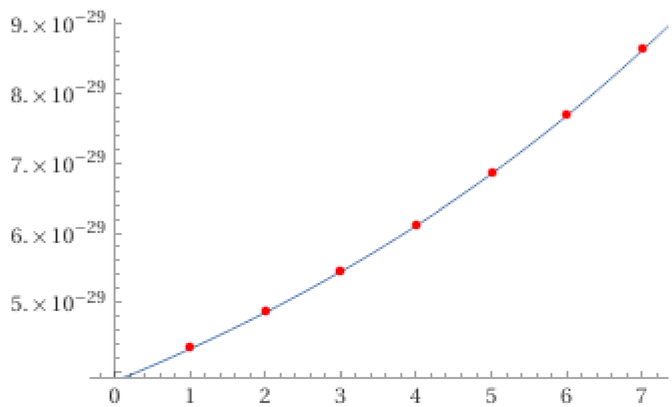

Figure 1. Polynomial Generated Output (Hadronic Mass)
3.8968036300000324*^-29 + 4.383340406665931*^-30 x + 2.522142833339474*^-31 x^2 + 9.86172083308624*^-33 x^3 + 3.0580833338499376*^-34 x^4 + 6.022499994602563*^-36 x^5 + 2.5833333355583285*^-37 x^6

This is a polynomial of degree 6 showing the hadronic mass increase in this sector. Its R^2 fit is 1. The perfect fit could be an over fit if the polynomials approximations fail.

Curve {0.006818017, 0.006831893, 0.006845864, 0.006859929, 0.006874091, 0.006888349, 0.006902706}

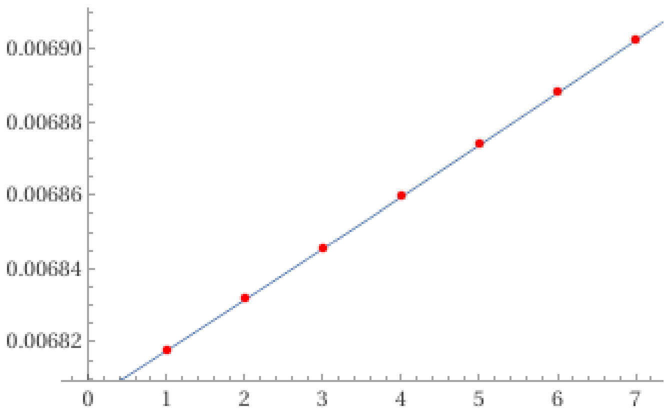

Figure 2. Polynomial Generated Output (Fine Structure Constant)
0.00680426 + 0.0000136659 x + 1.0542222221222584*^-7 x^2 - 2.383333332928148*^-8 x^3 + 5.055555554665408*^-9 x^4 - 5.333333332333119*^-10 x^5 + 2.2222222217753498*^-11 x^6

This is a polynomial of degree 6 showing the fine structure constant increasing in this sector. The R^2 fit is 1. Again it is possible that this an over fit if approximations fail.

Curve {1.00337964, 1.00338135, 1.00338307, 1.00338481, 1.00338655, 1.00338831, 1.00339007}

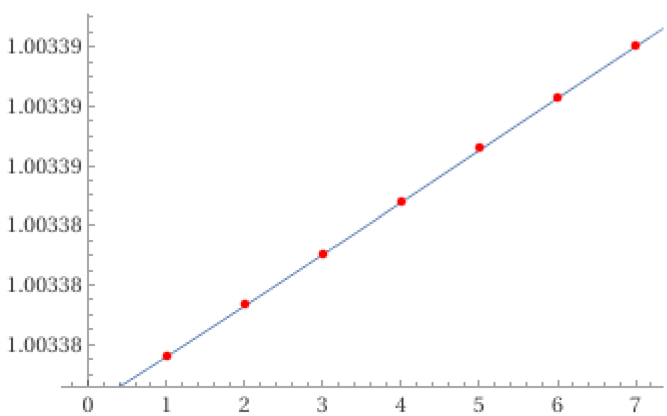

Figure 3. Polynomial Generated Output (Gravitational Scalar)
1.00338 + 2.1391666727728524*^-6 x - 3.769444494150267*^-7 x^2 + 1.5820833527505027*^-7 x^3 - 3.390277816816907*^-8 x^4 + 3.625000039031221*^-9 x^5 - 1.5277777931642875*^-10 x^6

This is a polynomial of degree 6 showing the Gravitational Scalar increasing in this sector. The R^2 fit is at 1.

Curve {2.48824893 10^-28, 2.48824468 10^-28, 2.48824041 10^-28, 2.48823611 10^-28, 2.48823179 10^-28, 2.48822744 10^-28, 2.48822306 10^-28}

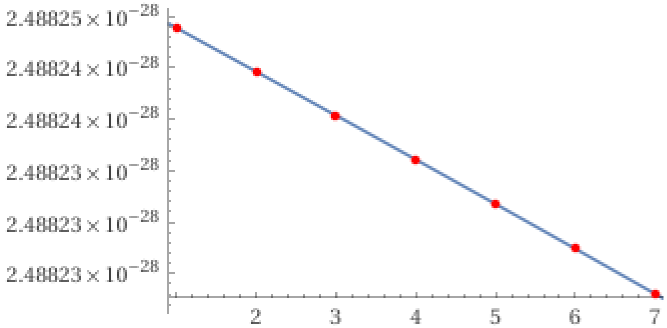

Figure 4. Polynomial Generated Output (Charged Pi-Meson Mass)
2.4882533000000073*^-28 - 4.542833351080599*^-34 x + 2.620555714881668*^-35 x^2 - 1.097916734618241*^-35 x^3 + 2.28472237003919*^-36 x^4 - 2.375000158223701*^-37 x^5 + 9.722222883033173*^-39 x^6

This is a polynomial of degree 6. This shows the charged pion mass decreasing in this sector. The R^2 fit is 1[3].

Curve {1.82185902 10^-30, 1.82185948 10^-30, 1.82186006 10^-30, 1.82186058 10^-30, 1.82186111 10^-30, 1.82186164 10^-30, 1.82186217 10^-30}

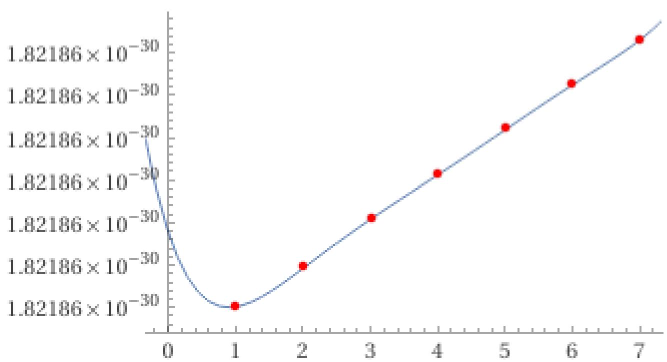

Figure 5. Polynomial Generated Output (Electron-Positron Mass)
1.8218598599999905*^-30 - 2.3533333126457004*^-36 x + 2.1706666500804492*^-36 x^2 - 7.966666602210411*^-37 x^3 + 1.537499986959646*^-37 x^4 - 1.4999999867923277*^-38 x^5 + 5.83333328042938*^-40 x^6

[3] Instead of saying that these polynomials are over fit repeatedly it should just be said that this is the case for almost all non-integer polynomials generated with the *Mathematica.* At the end this will be briefly touched upon in regards to the programs limitation and the mini-data sets.

This is a polynomial of degree 6. This shows the electron- positron annihilation pair increasing in this sector. Note the inflection beginning is not meaningful. The R^2 fit is 1.

<u>Dataset Sector 2 from 166, 165, 164, 163, 162, 161, 160</u>
This array integer range includes the neighborhood where our physics values lie. This occurs uniquely at the value integer 163.

Curve {1.15991869 10^-27, 1.31055605 10^-27, 1.48130534 10^-27, 1.674927405 10^-27, 1.89457279 10^-27, 2.14383832 10^-27, 2.42683212 10^-27}

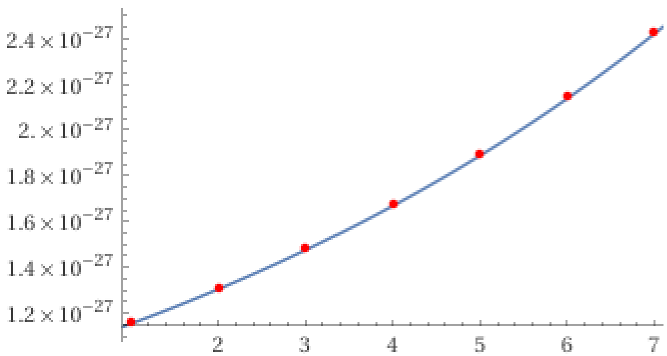

Figure 6. Polynomial Generated Output (Hadronic Mass)
1.0269739749999999*^-27 + 1.2482765216666673*^-28 x + 7.776381888888088*^-30 x^2 + 3.292275000004598*^-31 x^3 + 1.1216388888755605*^-32 x^4 + 2.2533333335182884*^-34 x^5 + 1.17222222212544*^-35 x^6

This is a polynomial of degree 6. The hadronic mass increases in this sector. The R^2 fit is 1.

Curve {0.007246073, 0.007263064, 0.00728019, 0.00729745, 0.007314847, 0.007332383, 0.00735006}

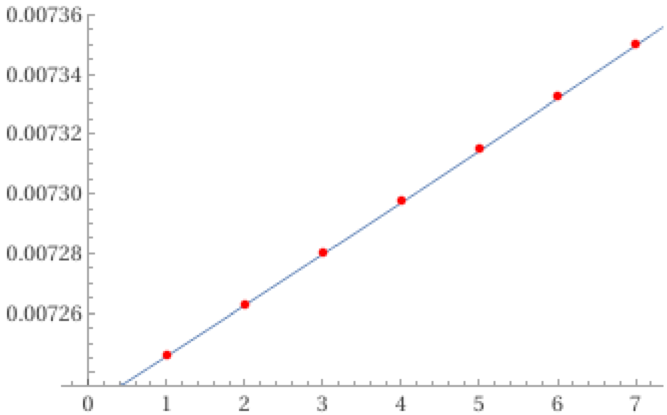

Figure 7. Polynomial Generated Output (Fine Structure Constant)
0.00722923 + 0.0000167522 x + 9.724166670903485*^-8 x^2 - 1.1500000017363352*^-8 x^3 + 2.2500000037354263*^-9 x^4 - 2.1666666706968227*^-10 x^5 + 8.333333350490013*^-12 x^6

This is a polynomial of degree 6. This shows the fine structure constant increasing in this sector. The R^2 fit is 1.

Curve {1.00343200, 1.00343406, 1.00343614, 1.00343823, 1.00344034, 1.00344246, 1.0034446}

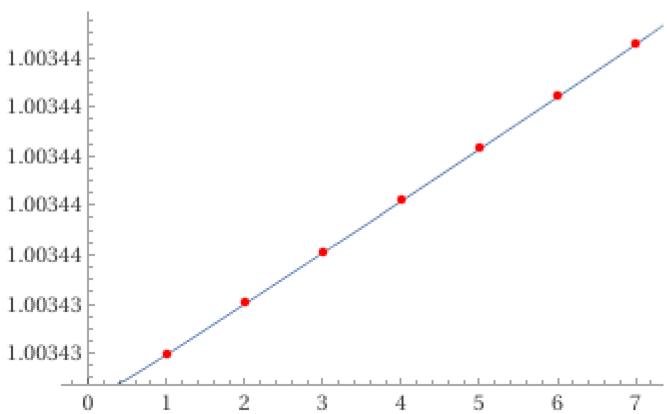

Figure 8. Polynomial Generated Output (Gravitational Scalar)
1.00343 + 1.6826666613733978*^-6 x + 3.0461111541171693*^-7 x^2 - 1.2000000170856907*^-7 x^3 + 2.5277778131463264*^-8 x^4 - 2.6666667031956953*^-9 x^5 + 1.111111125946047*^-10 x^6

This is a polynomial of degree 6. This shows the gravitational scalar increasing in this sector. The R^2 fit is 1.

Curve {2.48811909 10^-28, 2.48811398 10^-28, 2.48810883 10^-28, 2.48810364 10^-28, 2.48809842 10^-28, 2.48809315 10^-28, 2.48808785 10^-28}

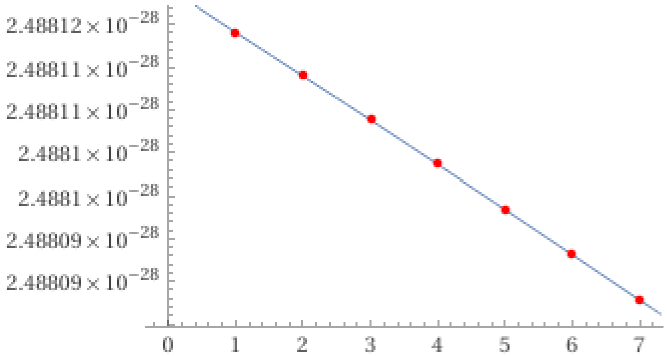

Figure 9. Polynomial generated Output (Charged Pi-Meson Mass)
2.4881243199999986*^-28 - 5.431666662719639*^-34 x + 3.176944413009528*^-35 x^2 - 1.4479166557380927*^-35 x^3 + 3.2152777581837046*^-36 x^4 - 3.541666648215082*^-37 x^5 + 1.5277777704044457*^-38 x^6

This is a polynomial of degree 6. This shows the charged pion mass decreasing in this sector. . The R^2 fit is 1.

Curve {1.82187486 10^-30, 1.82187548 10^-30, 1.82187611 10^-30, 1.82187675 10^-30, 1.82187738 10^-30, 1.82187803 10^-30, 1.82187867 10^-30}

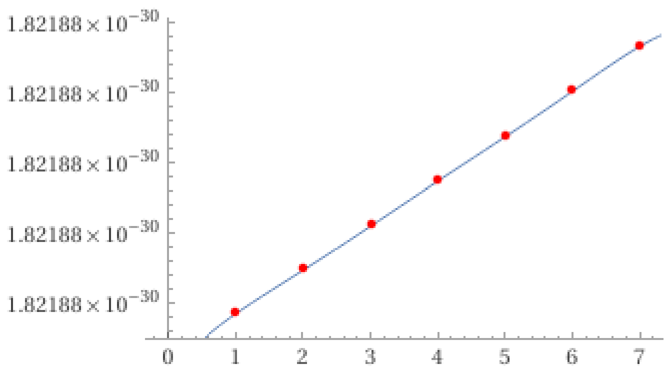

Figure 10. Polynomial Generated Output (Electron-Positron Mass)
1.8218739799999957*^-30 + 1.2475000096217811*^-36 x - 5.614166739148896*^-37 x^2 + 2.416666692008438*^-37 x^3 - 5.333333378105983*^-38 x^4 + 5.8333333719031545*^-39 x^5 - 2.500000012776444*^-40 x^6

This is a polynomial of degree 6. This shows the electron-positron annihilation pair increasing in this sector. The R^2 fit is 1.

Dataset Sector 3 from 100, 99, 98, 97, 96, 95, 94
This integer range lies in the middle of the integer array,

Curve {9.98673788 10^-24, 1.16899828 10^-23, 1.36946325 10^-23, 1.60560419 10^-23, 1.88401195 10^-23, 2.21254167 10^-23, 2.60056464 10^-23}

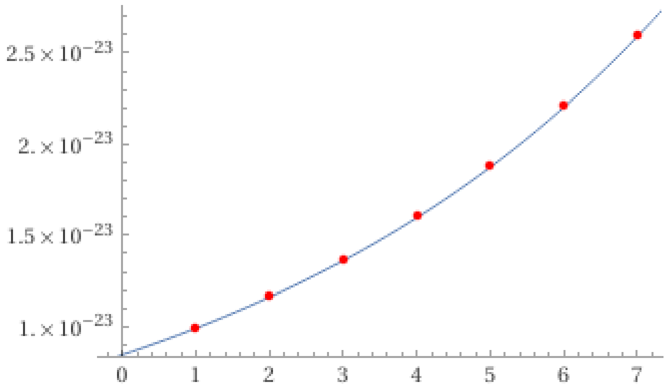

Figure 11. Polynomial Generated Output (Hadronic Mass)
8.538436360000011*^-24 + 1.3343540229999646*^-24 x + 1.0778889738892736*^-25 x^2 + 5.8702066666479394*^-27 x^3 + 2.829063888934117*^-28 x^4 + 4.890333332804042*^-30 x^5 + 5.962222222461012*^-31 x^6

This is a polynomial of degree 6. This shows the hadronic mass increasing in this sector. The R^2 fit is 1.

Curve {0.008775173, 0.008807619, 0.008840477, 0.008873758, 0.008907470, 0.008941623, 0.008976228}

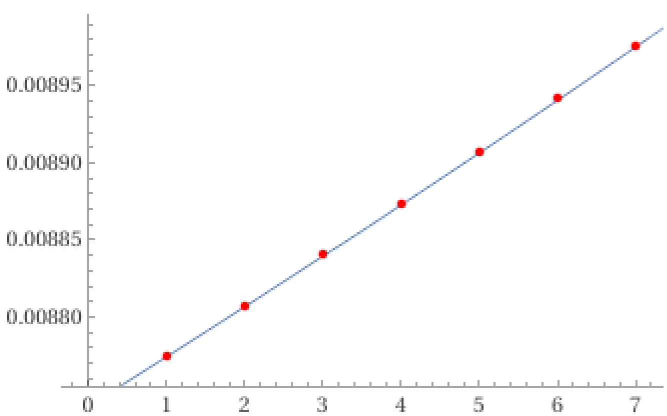

Figure 12. Polynomial Generated Output (Fine Structure Constant)

0.00874311 + 0.0000318805 x + 1.6771666664872009*^-7 x^2 + 1.2750000007614125*^-8 x^3 - 2.2083333348726833*^-9 x^4 + 2.166666668132226*^-10 x^5 - 8.333333338603014*^-12 x^6

This is a polynomial of degree 6. This shows the fine structure constant increasing in this sector. The R^2 fit is 1.

Curve {1.00361512, 1.00361900, 1.00362293, 1.00362691, 1.00363095, 1.00363504, 1.00363919}

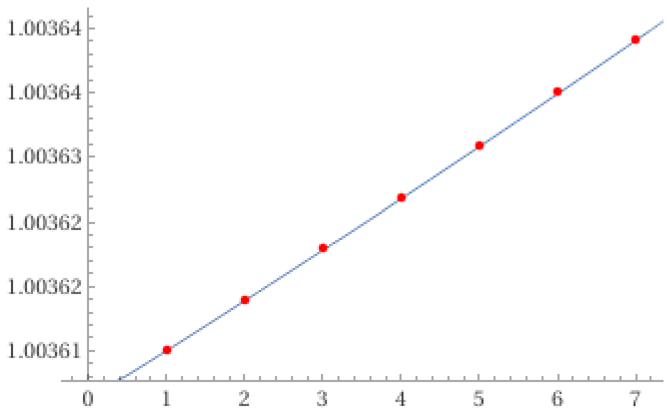

Figure 13. Polynomial Generated Output (Gravitational Scalar)
1.00361 + 3.5441666681124026*^-6 x + 2.5372222124707123*^-7 x^2 - 9.687499973506289*^-8 x^3 + 2.1180555525518388*^-8 x^4 - 2.2916666656917874*^-9 x^5 + 9.722222224814991*^-11 x^6

This is a polynomial of degree 6. This shows the gravitational scalar increasing in this sector. The R^2 fit is 1.

Curve {2.48766510 10^-28, 2.48765549 10^-28, 2.48764575 10^-28, 2.48763588 10^-28, 2.48762587 10^-28, 2.48761574 10^-28, 2.48760546 10^-28}

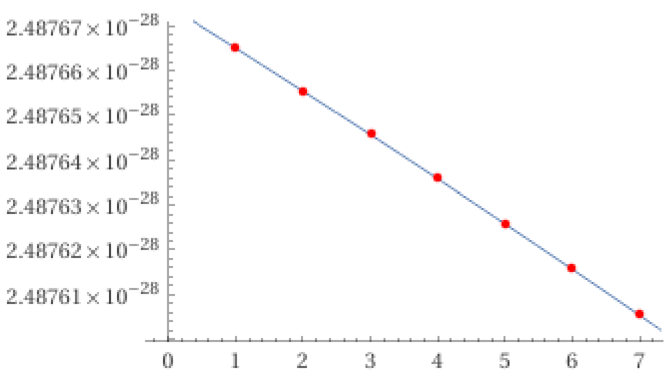

Figure 14. Polynomial Generated Output (Charged Pi-Meson Mass)
2.4876744100000018*^-28 - 9.008833336993827*^-34 x - 4.2524999758336955*^-35 x^2 + 1.549999992741497*^-35 x^3 - 3.4583333224771866*^-36 x^4 + 3.833333325366884*^-37 x^5 - 1.6666666642860935*^-38 x^6

This is a polynomial of degree 6. This shows the charged pion mass decreasing in this sector. The R^2 fit is 1.

Curve {1.82193027 10^-30, 1.82193144 10^-30, 1.82193263 10^-30, 1.82193384 10^-30, 1.82193506 10^-30, 1.82193630 10^-30, 1.82193755 10^-30}

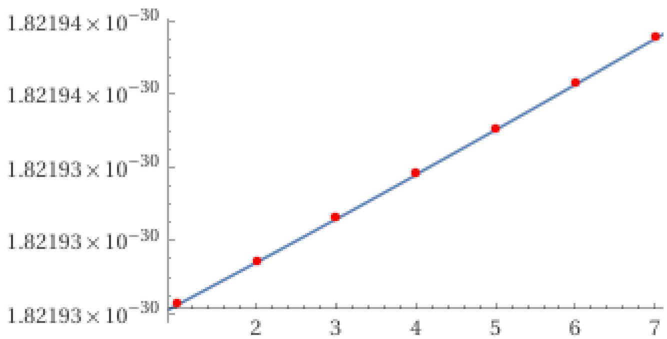

Figure 15. Polynomial Generated Output (Electron-Positron Mass)
1.821929010000003*^-30 + 1.4008333266019862*^-36 x - 2.187222168366089*^-37 x^2 + 9.68749979698212*^-38 x^3 - 2.118055516263961*^-38 x^4 + 2.2916666287488754*^-39 x^5 - 9.722222077282725*^-41 x^6

This is a polynomial of degree 6. This shows the electron-positron annihilation pair increasing in this sector. The R^2 fit is 1.

Dataset Sector 4 from 14, 13,12, 11, 10, 9, 8

This array integer range shows possible inflections and changes in vacuum and gravitational energies. The gravitational scalar and charged pion mass indicate a relationship.

Curve {3.45269588 10^-15, 5.29490639 10^-15, 8.25750525 10^-15, 1.31238951 10^-14, 2.13132817 10^-14, 3.54860882 10^-14, 6.08342421 10^-14}

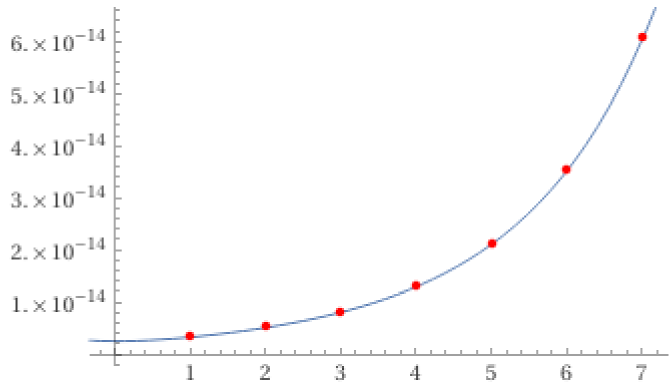

Figure 16. Polynomial Generated Output (Hadronic Mass)
2.662732619999888*^-15 - 2.2299182333088 21*^-17 x + 1.1136210628609176*^-15 x^2 - 4.046566231249273*^-16 x^3 + 1.1727712506943044*^-16 x^4 - 1.4930334541665335*^-17 x^5 + 9.51212069444395*^-19 x^6

This is a polynomial of degree 6. This shows the hadronic mass increasing in this sector. The R^2 fit is 1.

Curve {0.016479459, 0.016809008, 0.017166454, 0.017556518, 0.017985203, 0.018460318, 0.018992278}

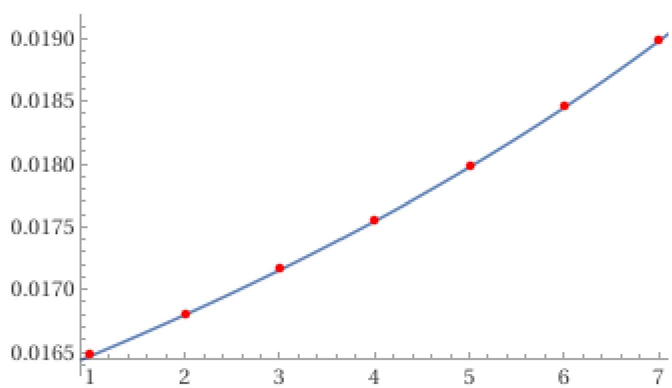

Figure 17. Polynomial Generated Output (Fine Structure Constant)
0.0161741 + 0.000294208 x + 0.0000107371 x^2 + 3.4208333327829233*^-7 x^3 + 5.5000000012035415*^-8 x^4 - 3.6833333346407584*^-9 x^5 + 3.8333333338909867*^-10 x^6

This is a polynomial of degree 6. This shows the fine structure constant increasing in this sector. The R^2 fit is 1.

Curve {1.00579071, 1.00587962, 1.00529324, 1.00502503, 1.00484580, 1.00470888, 1.00459641}

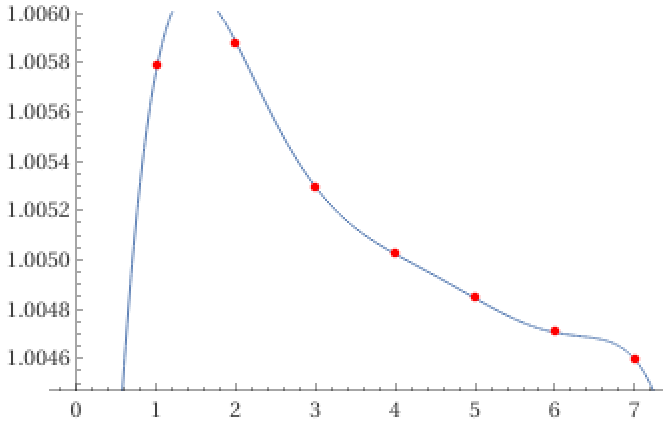

Figure 18. Polynomial Generated Output (Gravitational Scalar)
0.999846 + 0.0124981 x - 0.00926497 x^2 + 0.0032617 x^3 - 0.000605484 x^4 + 0.0000571771 x^5 - 2.1651111111107047*^-6 x^6

This is a polynomial of degree 6. This shows the gravitational scalar decreasing in this sector. The R^2 fit is 1. Inflection and or critical point is occurring whereby the gravitational scalar begins to decrease.

Curve {2.48228412 10^-28, 2.48206473 10^-28, 2.48351248 10^-28, 2.48417526 10^-28, 2.48461835 10^-28, 2.48495696 10^-28, 2.48523514 10^-28}

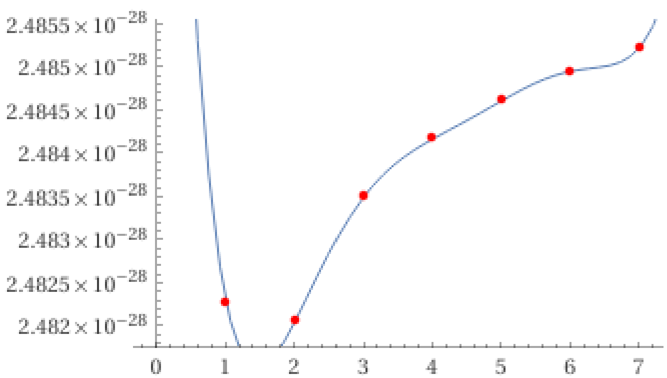

Figure 19. Polynomial Generated Output (Charged Pi-Meson Mass)
2.4969539799999987*^-28 - 3.084283766666034*^-30 x + 2.286322913888112*^-30 x^2 - 8.048551041662768*^-31 x^3 + 1.494038680554628*^-31 x^4 - 1.4108129166656211*^-32 x^5 + 5.342180555551057*^-34 x^6

This is a polynomial of degree 6. This shows the charged pion mass increasing in this sector. The R^2 fit is 1. Inflection and or critical point is occurring whereby the charged pion mass begins to increase.

Curve {1.82258793 10^-30, 1.82261478 10^-30, 1.82243765 10^-30, 1.82235661 10^-30, 1.82230244 10^-30, 1.82226105 10^-30, 1.82222705 10^-30}

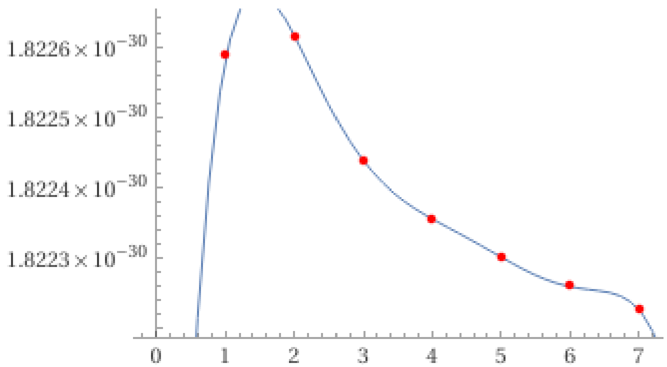

Figure 20. Polynomial Generated Output (Electron-Positron Mass)
1.8207924699999998*^-30 + 3.7749773333361425*^-33 x - 2.79842375000086*^-33 x^2 + 9.85172708333131*^-34 x^3 - 1.8288229166653234*^-34 x^4 + 1.72699583333122*^-35 x^5 - 6.539583333322612*^-37 x^6

This is a polynomial of degree 6. This shows the charged electron-positon annihilation pair decreasing in this sector. The R^2 fit is 1. Inflection and or critical point is occurring whereby the charged electron-positron annihilation pair begins to decrease.

Dataset Sector 5 from 7, 6, 5, 4, 3, 2, 1

This array integer range finishes bookending the array integers from 194 to 1.

Curve {1.07990776 10^-13, 2.00060480 10^-13, 3.91155026 10^-13, 8.21172660 10^-13, 1.90553980 10^-12, 5.71210872 10^-12, 1.90025041 10^-11}

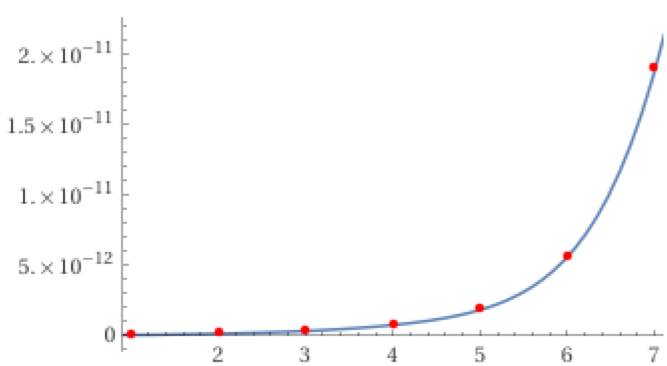

Figure 21. Polynomial generated Output (Hadronic Mass)

5.381270219999768*^-13 - 1.3079878095666175*^-12 x + 1.4839998216444025*^-12 x^2 - 8.153093885416493*^-13 x^3 + 2.439216738194407*^-13 x^4 - 3.707227789166627*^-14 x^5 + 2.311734536111094*^-15 x^6

This is a polynomial of degree 6. This shows the charged hadronic mass increasing in this sector. The R^2 fit is 1.

Curve {0.019595413, 0.020290232, 0.021107607, 0.022097314, 0.023347901, 0.025043407, 0.027697859}

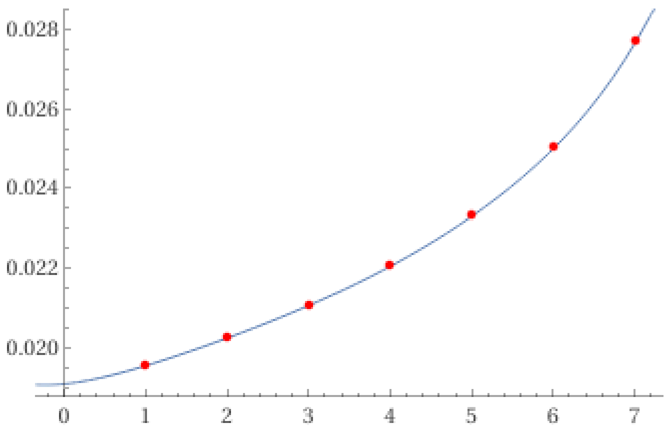

Figure 22. Polynomial Generated Output (Fine Structure Constant)
0.0191332 + 0.000215418 x + 0.000362685 x^2 - 0.000149165 x^3 + 0.0000377356 x^4 - 4.7125333333340925*^-6 x^5 + 2.4691388888891947*^-7 x^6

This is a polynomial of degree 6. This shows the fine structure constant increasing in this sector. The R^2 fit is 1.

Curve {1.00449955, 1.00441312, 1.00433366, 1.00425848, 1.00418502, 1.004103321, 1.00402649}

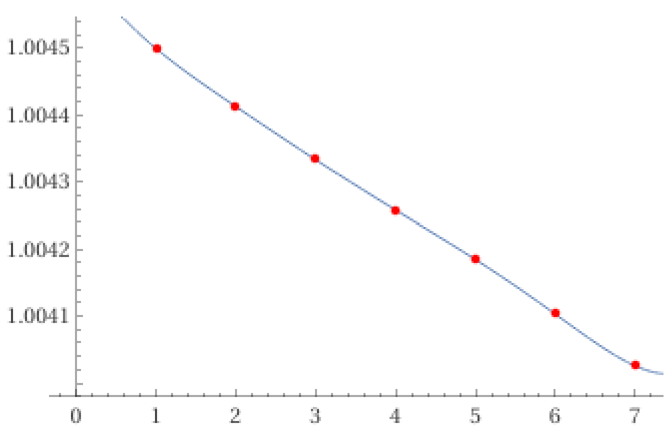

Figure 23. Polynomial Generated Output (Gravitational Scalar)
1.00464 - 0.000212364 x + 0.000106179 x^2 - 0.0000446211 x^3 + 0.0000101812 x^4 - 1.1708999998953043*^-6 x^5 + 5.2769444440029325*^-8 x^6

This is a polynomial of degree 6. This shows the gravitational scalar decreasing in this sector. The R^2 fit is 1.

Curve {2.48547479 10^-28, 2.48568867 10^-28, 2.48588534 10^-28, 2.48607144 10^-28, 2.48625330 10^-28, 2.48645558 10^-28, 2.48664585 10^-28}

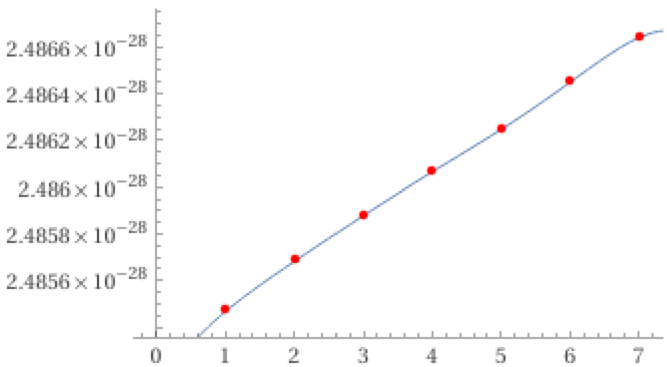

Figure 24. Polynomial Generated Output (Charged Pi-Meson Mass)
2.48512405*^-28 + 5.25522499998988*^-32 x - 2.6280463888705984*^-32 x^2 + 1.1045874999872753*^-32 x^3 - 2.5204722221832304*^-33 x^4 + 2.8987499999462617*^-34 x^5 - 1.3063888888616267*^-35 x^6

This is a polynomial of degree 6. This shows the charged pion mass increasing in this sector. The R^2 fit is 1.

Curve {1.82219777 10^-30, 1.82217163 10^-30, 1.82214761 10^-30, 1.82212487 10^-30, 1.82210266 10^-30, 1.82207795 10^-30, 1.82205471 10^-30}

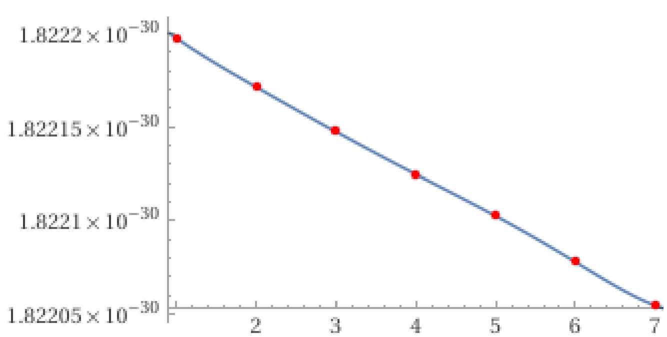

Figure 25. Polynomial Generated Output (Electron-Positron Mass)

1.822240980000008*^-30 - 6.500150001728205*^-35 x + 3.275222223597876*^-35 x^2 - 1.374895833856938*^-35 x^3 + 3.131597223250098*^-36 x^4 - 3.5954166676710383*^-37 x^5 + 1.6180555559424392*^-38 x^6

This is a polynomial of degree 6. This shows the electron-positron annihilation pair decreasing in this sector. The R^2 fit is 1. This finishes the bookending of the 5 presented data sectors.

Limitations of the Data Sets and Computation

All 5 data sets consisting of a string of seven data points is very restrictive as to accuracy of the overall structure that is actually involved. The programing is limited due to the non-integer nature of obtaining output beyond 7 data points. As such all sectors show polynomials of degree 6 (sextic) with perfect fits of $R^2 = 1$. It's possible that many of these are over fit and only may work for a short distance in approximations. Obviously, much bigger computational power is required with stronger algorithms. If there is a Master polynomial across the array it may produce 194 eigenvalues for the diagonal trace, to support idea of a World Scalar involved with this method.

The Strange Invariant $kg = 1$ in the Anthropic SI Usage

In the list of invariants the unitary value of the kilogram was forwarded. In equations **1** and **2** the scalar ϕ is dimensionless. The scalar in **1** has the Planck mass squared M_{pl}^2 with no apparent cancelation of its dimension. The scalar in **2** suffers from the use of M_{pl}^2 as well. If both equations are equivalent then the scalar in **1** and **2** should be dimensionless. A simple operation which does not affect the calculation is to simply place kg^2 in the denominator under the M_{pl}^2. Since both are invariant in these calculations it implies that the unitary value of a system that is designated around the unitary value of the kilogram may determine the value for the Planck mass. The use of a system that uses a unitary base value of energy or mass would be likely for any other non-anthropic system developed somewhere else. It is only likely that the two separately developed systems would have to be converted (which would be quite easy) to understand each other's calculations. Considering, relativity in this picture the total number of atoms would not change in the kilogram under its influence and the unitary value does not change saving the Planck mass-energy as an invariant.

Suppression of the Exponential

The scalar ϕ contains unique radicals. A thought why the running of the values works so well is probably due to suppression of exponentials. One radical is a root $1/65536$ or $1/2^{16}$. This is under the denominator and the final radical has a root $1/2048$ or $1/2^{11}$ which polishes the result.

Final Thoughts

Obviously, more computer power and stronger algorithms are needed to investigate this in the future. The author has limited scope in that regard. If the equations presented in this work are viable (maybe not, perhaps a crazy numerology)) then these open up a New

World into using a natural mathematical object for physics which may possibly be encoded in such a structure as the Monster group. It's possible that these calculations just look good and have no meaning but they otherwise do need to be investigated. A most interesting aspect in all of this is that there appears to be a symmetry relation between the gravitational scalar and the charged pi-meson mass in this *schema* and that this implies new physics. It therefor remains that if this is something that works then it also opens up a New World in the ongoing *Einstein Revolution.*

Appendix A

Mathematica programs for the equations in this work.

The first equation **1** rendered in *Mathematica* utilizing 2022 Codata and aligned values. The variables can be changed easily. This was the primary equation used as it contains the hadron.

```
16 ((1/((((6.62607015 10^-34 299792458)/((2 Pi) 6.67354204 10^-11 1.67262192595 10^-27
1.67492750056 10^-27)) Sqrt[2] (2.17642551 10^-8^2/0.0072973525643))^(1/65536) -
1))^(1/2048))^5  (2.17642551 10^-8^2/1.8218767427 10^-30^2) ((2.48810367 10^-
28)^2/1.8218767427 10^-30^2) ((2.48810367 10^-28)^2/1.8218767427 10^-30^2) ==
8.0801742479 10^53
```

The second equation **2** contains the identity using the fine structure constant which has 11 significant figures. This was important for determining a new *G* to 8 significant figures, which also affected the Planck mass value.

```
16 ((1/((2 (E/2)^(1/4) Exp[Pi/(4 0.0072973525643)] 0.0072973525643^3 (Sqrt[2]/2)
2.17642551 10^-8^2)^(1/65536) - 1))^(1/2048))^5 (2.17642551 10^-8^2/1.8218767427 10^-
30^2) (x^2/1.8218767427 10^-30^2) (x^2/1.8218767427 10^-30^2) == 8.0801742479 10^53
```

Equation **6** used to balance the identity by solving for a new *G* with more significant figures.

```
((6.62607015 10^-34 299792458)/(Pi x 1.67262192595 10^-27 1.67492750056 10^-27))
(Sqrt[2]/2) (1/0.0072973525643) == 2 (E/2)^(1/4) Exp[Pi/(4 0.0072973525643)]
0.0072973525643^3 (Sqrt[2]/2)
```

Some References

[1.] Conway J. H. , Curtis R.T., Norton S. P., Parker R. A., and Wilson R. A., (1985) 'Atlas of FINITE GROUPS, Clarendon Press 1985

[2.] Thomas, Mark (2024), 'Monster Symmetry, a Mini Computational Workshop* CODATA Invariants in a Symmetry Operation v2, viXra

[3.] National Institute of Standards and Technology (NIST), The NIST Reference on Constants, Units and Uncertainty, Fundamental Physical Constants, *CODATA* Internationally recommended 2018 and 2022

values of the Fundamental Physical Constants, Gaithersburg, MD
https://www.nist.gov/programs-projects/codata-values-fundamental-physical-constants
and https://physics.nist.gov/cuu/Constants/

[4.] Wolfram Research, Inc., Mathematica, Version 13.1, Champaign, IL (2022).
URL: https://www.wolfram.com/mathematica

[5.] Ronan, Mark (2006), 'Symmetry and the Monster, One of the Greatest Quests of Mathematics' New York, Oxford University Press 2006 Page 227.

[6.] Particle Data Group (PDG), R.L. Workman et al. (Particle Data Group)
Prog. Theor. Exp. Phys. 2022, 083C01 (2022) , https://pdg.lbl.gov/