ON THE COSMIC NUMBER

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Richard Feynman: “There is a most profound and beautiful question associated with the observed coupling constant, e – the amplitude for a real electron to emit or absorb a real photon. It is a simple number that has been experimentally determined to be close to 0.08542455. (My physicist friends won’t recognize this number, because they like to remember it as the inverse of its square: about 137.03597 with about an uncertainty of about 2 in the last decimal place. It has been a mystery ever since it was discovered more than fifty years ago, and all good theoretical physicists put this number up on their wall and worry about it.) Immediately you would like to know where this number for a coupling comes from: is it related to pi or perhaps to the base of natural logarithms? Nobody knows. It’s one of the greatest damn mysteries of physics: a magic number that comes to us with no understanding by man. You might say the “hand of G-d” wrote that number, and “we don’t know how He pushed his pencil.” We know what kind of a dance to do experimentally to measure this number very accurately, but we don’t know what kind of dance to do on the computer to make this number come out, without putting it in secretly!”[1] In this note, a “computational dance” from which this number emerges without any need to put it in secretly is identified...

Let

$$\hbar = \text{the reduced Planck constant} = 6.66134 \times 10^{-16}$$
$$G = \text{the Gibbs constant} = \int_0^{\pi} \frac{\sin(x)}{x}\, dx$$

and let

$$R_\infty = \text{ the Rydberg constant}$$
$$e = \text{the elementary charge}$$
$$c = \text{the speed of light in a vacuum}$$
$$\epsilon_0 = \text{the electric constant}$$
$$\mu_0 = \text{the magnetic constant}$$
$$R_K = \text{the von Klitzing constant}$$
$$Z_0 = \text{vacuum impedance}$$

α is derived from the measurement of the ratio $\frac{\hbar}{m R_b}$ between the Planck constant and the mass of the R_b atom because

$$\alpha^2 = \frac{2 R_\infty}{c} \frac{m R_b}{m_e} \frac{\hbar}{m R_b}$$

where m_e is the electron mass. The recommended CODATA value is

$$\alpha = 7.2973525664 \times 10 \wedge -3 = \frac{1}{137.036} = \left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}} - \int_1^1 \frac{1.00009}{1^{12}}\, dn\right)}\right)^2\right)^2$$

And so

$$\left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}} - \int_1^1 \frac{1.00009}{1^{12}}\, dn\right)}\right)^2\right)^2 =$$

$$\frac{1}{\frac{\left(\frac{3\pi}{2}\right)^3 G}{\sqrt{2}}} = \sqrt{\frac{2 R_\infty}{c} \frac{m R_b}{m_e} \frac{\hbar}{m R_b}} = \frac{e^2}{4\pi\epsilon_0 \hbar c} = \frac{1}{4\pi\epsilon_0} = \frac{e^2}{\hbar c} = \frac{\pi \mu_0}{4} \frac{e^2 c}{\hbar} = \frac{k_e e^2}{\hbar c} = \frac{c \mu_0}{2 R_K} = \frac{e^2}{4\pi} \frac{Z_0}{\hbar}$$

Let

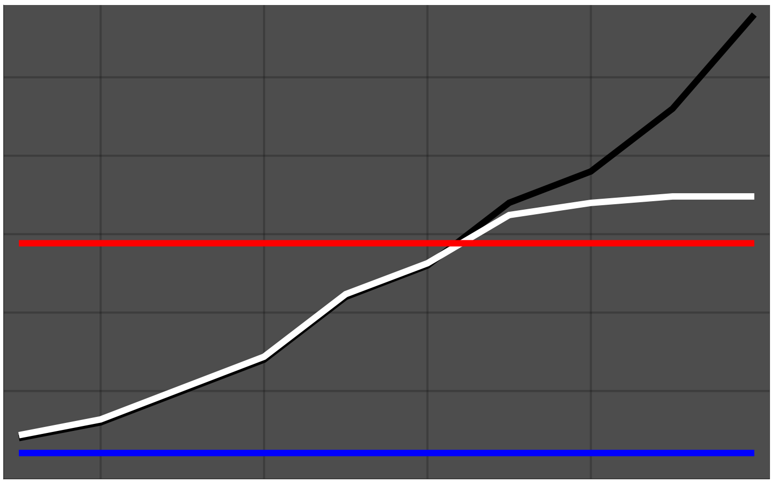
$$\alpha_G = \text{the gravitational coupling constant}$$

and in Planck units

$$\left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1.00009}{1^{12}} - \int_1^1 \frac{1.00009}{1^{12}}\, dn\right)}\right)^2\right)^2 = \alpha_G\left(\left(\frac{e}{m_e}\right)^2\right)$$

There is a difference of 0.0000127295 between the recommended value of α and $\left(e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1}{1^{12}} - \int_1^1 \frac{1}{1^{12}}\, dn\right)}\right)^2\right)^2$, but this difference is within the bounds of the variations in the fine-structure constant suggested by data on quasars. [2-4]

Arguably then, we have a non-arbitrary, non-subjective, number-line/time-line, whose units are associated to the fundamental physical constants as we know them from observation, and have a certain minimum and maximum size given at the one extreme by the Planck constant and at the other by the fine-structure constant:



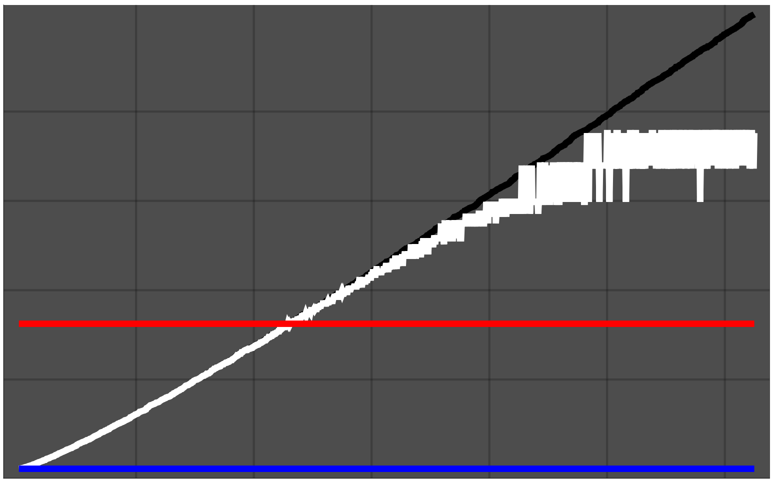
$e^{2\gamma}\sqrt{\frac{p_x}{e^{2\gamma}}}^{\,2}$

$\sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{p_x}\frac{1}{n^{12}}-\int_1^{p_x}\frac{1}{n^{12}}\,dn\right)\right)\right)^2}}$ $\sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{\hbar}}$ $\sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{\sqrt{\alpha}}}$

But it is clear that this is a *local* -a discontinuous- pair of lines, particular to a single cross-section of a global pair. Refining α as

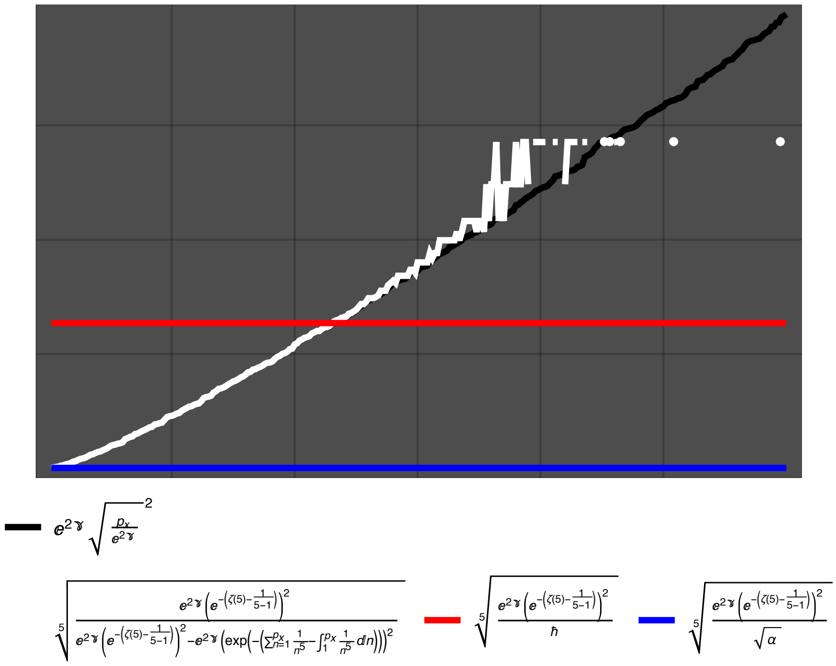
$$\alpha = \left(e^{2\gamma}\left(e^{-\left(\zeta(s)-\frac{1}{s-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{1}\frac{1}{1^s}-\int_1^1\frac{1}{1^s}\,dn\right)}\right)^2\right)^2$$

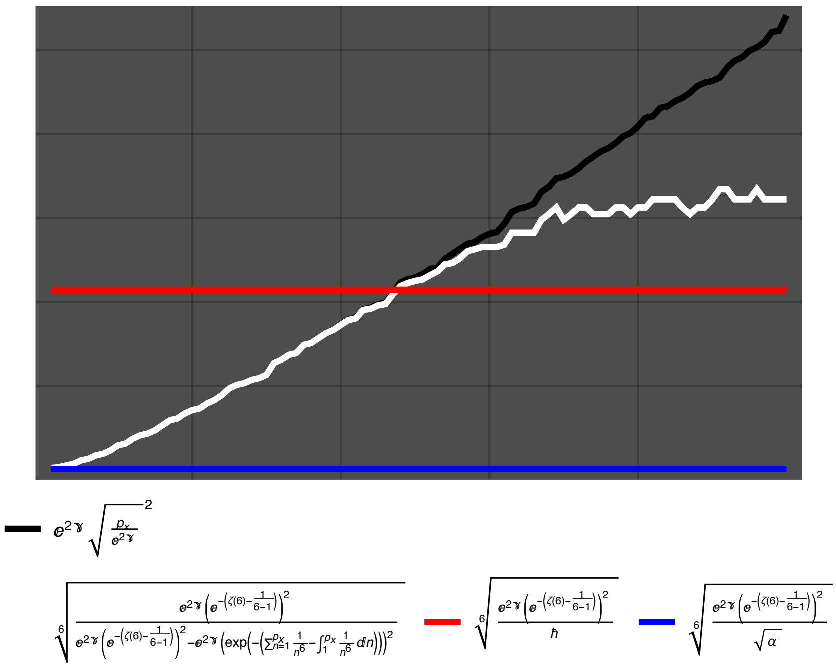
where s is a positive integer, we see that there are a potentially infinite number of these cross-sections, each associated to a different (positive) real value of s and to a potentially different set of potential constants:



$e^{2\gamma}\sqrt{\frac{p_x}{e^{2\gamma}}}^{\,2}$

$\sqrt[4]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(4)-\frac{1}{4-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(4)-\frac{1}{4-1}\right)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{p_x}\frac{1}{n^{4}}-\int_1^{p_x}\frac{1}{n^{4}}\,dn\right)\right)\right)^2}}$ $\sqrt[4]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(4)-\frac{1}{4-1}\right)}\right)^2}{\hbar}}$ $\sqrt[4]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(4)-\frac{1}{4-1}\right)}\right)^2}{\sqrt{\alpha}}}$





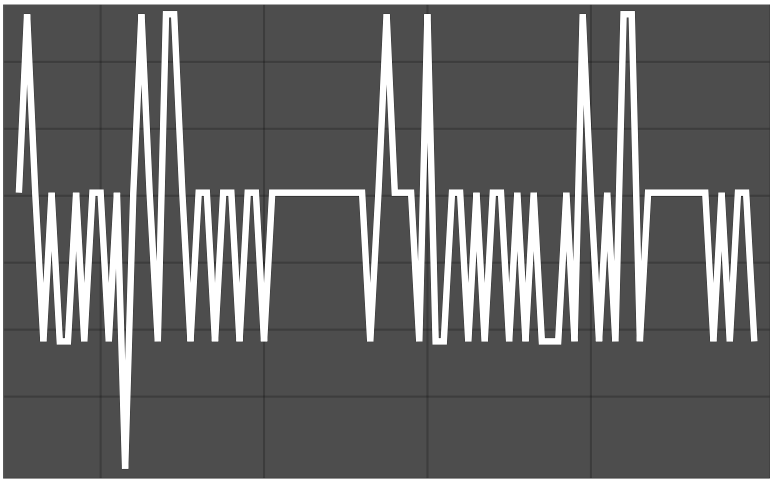
The *General Theory Relativity* in its present form says that space-time is curved by mass.[5] It follows that, in the beginning, all the mass of that universe was concentrated into a zero-dimensional point. That this idea is *a half-truth* is suggested by the implication of multiple singularities (at the centers of black holes)[6], the lack of a coherent mathematical framework for both large scale and small scale objects[7], and by the flat rotation curves of distant galaxies.[8] A similar idea that *doesn't* carry any absurd consequences is the idea of the infinite compression of energy (light), and the elimination of mass. Now curvature is to be attributed, not to mass - which is a combination of light and space- but to *imbalances* of light and space. Mathematically, we capture what it is to be balanced, and what it is to *depart* from balance, thereby producing curvature, by re-expressing the tradition equation for a circle of area 1 ($\pi\sqrt{\frac{1}{\pi}}^{2} = 1$) as

$$\lim_{x\to\infty} e^{2\gamma}\left(\sqrt{\frac{1}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n}-\int_1^x \frac{1}{n}\,dn\right)}}}\right)^2 = 1$$

Where the traditional equation fails by implying that an energy source located at the center of this area unit-circle is undiminished from center to circumference (it has either a zero or an infinite radius), the second provides us with a potentially infinite hierarchy of energy levels that are necessarily non-infinite and non-zero. Given that γ is a spacial case of $\zeta(s) - \frac{1}{s-1}$ for s =1, we can go from $\lim_{x\to\infty} e^{2\gamma} \sqrt{\frac{1}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n}-\int_1^x \frac{1}{n}\,dn\right)}}}^{\,2} = 1$ to the more general:

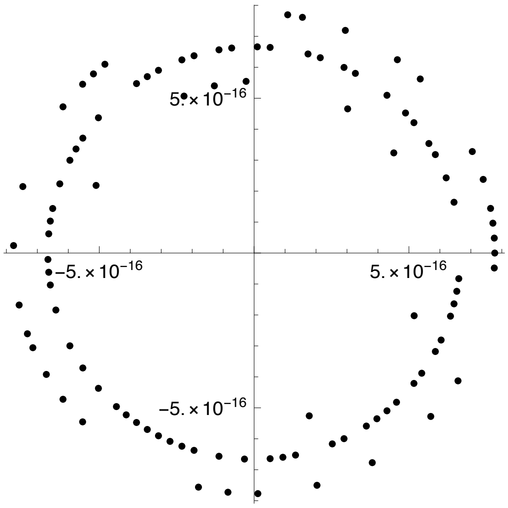
$$\lim_{x\to\infty} e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{\exp\left((s+1)\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_1^x \frac{1}{n^s}\,dn\right)\right)}\right)^{\frac{1}{s+1}}\right)^{s+1} = 1$$

which -by reference to s = 12- is how we arrived at the proposed understanding of the fine-structure constants. If we look beyond what we can call the Planck radius in the case of s = 12, we see the following wave-form that goes on forever within bounds prescribed by the Gibbs constant:



$$\sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2-e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{p_x}\frac{1}{n^{12}}-\int_1^{p_x}\frac{1}{n^{12}}\,dn\right)\right)\right)^2}}$$

A polar plot of the denominator alone on the narrow side of the Planck radius:



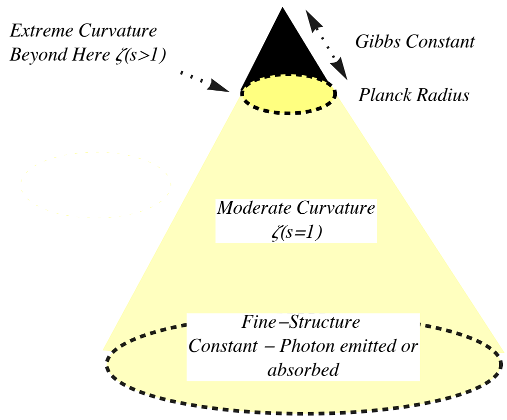
Since it is the differences between the partial sums/integrals and the limit that protect against the degeneration of a cosmic spiral into a circle with no radius (a point), or the degeneration of this spiral into a circle with *infinite* radius (a line), we know that these differences have minimum and maximum sizes. More particularly, we know that if and only if s = 1 then

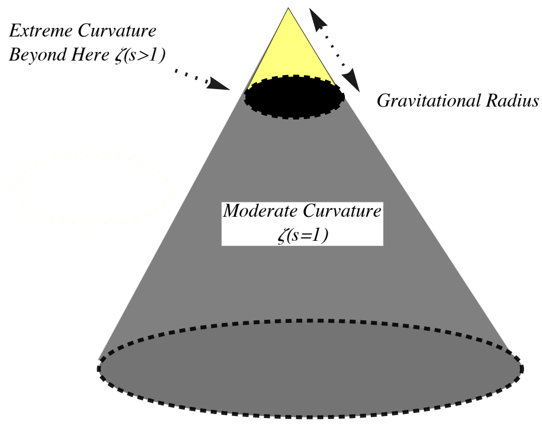
$$e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}\left(\left(\frac{1}{e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}}\right)^{\frac{1}{s+1}}\right)^{s+1} = e^{2\gamma}\sqrt{\frac{1}{e^{2\gamma}}}^{\,2} = 1$$

and the progression associated to

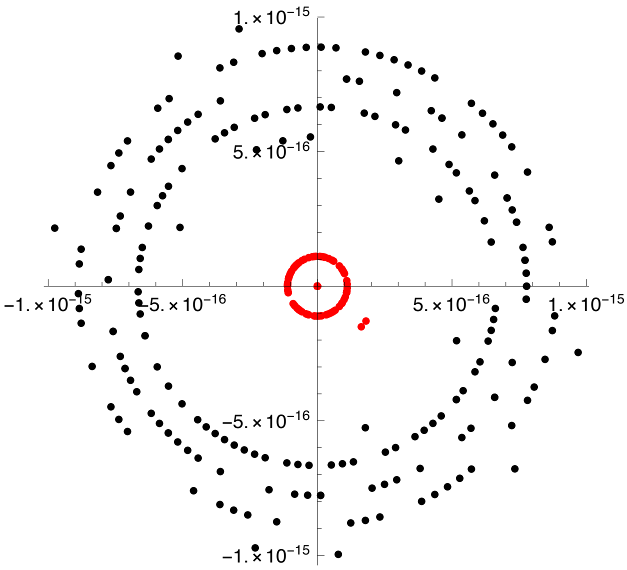
$$\left(\frac{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2}{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2 - e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{x}\frac{1}{n^s}-\int_1^x \frac{1}{n^s}\,dn\right)\right)\right)^2}\right)^{1/s}$$

is potentially infinite (in the case of $s = 1$, there the difference between the partial sum/integral is always larger than the Planck radius). If s is a positive real number *greater or less than 1*, then the progression is strictly finite. These two directions leading away from $s = 1$ give us two distinct notions of imbalance, and of curvature. If $s > 1$, then the imbalance is in favour of light, and if $s < 1$, the imbalance is in favour of space. We might therefore picture electromagnetism and gravity in this way:

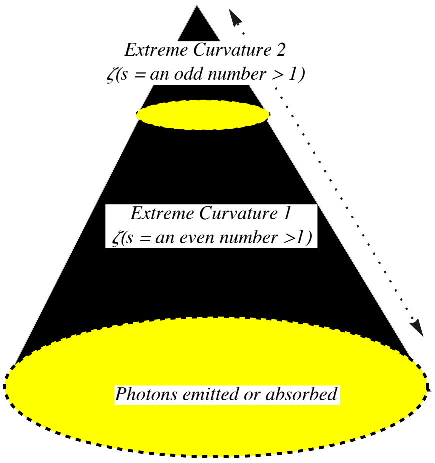




Combining polar plots of $s = 12, 14$ (black) and $s = 13, 15$ (red) shows that there is a still deeper level:


1. × 10^-15
5. × 10^-16
−1. × 10^-15
−5. × 10^-16
5. × 10^-16
1. × 10^-15
−5. × 10^-16
−1. × 10^-15

This consideration recommends the following extension:



Where the present universe is associated to units of a particular size, to a particular set of constants, and to a particular arithmetic/spatio-temporal epoch, these epochs clearly differ. But a key point is that the balance of prime/energy-density of the units belonging to each epoch is constrained by the value $s = 1$, and by the limit $e^{2\gamma} \sqrt{\frac{1}{e^{2\gamma}}}^{2} = 1$, and therefore by the balance of prime-density and sparsity associated to complex zeros of L-functions if and only if the real part of these zeros is equal in every case to 1/2[9]. This constraint ensures that the progressions associated to these units involve a potentially infinite number of primes: let g = Graham's number[10] (if every digit in Graham's number is considered to occupy as little as 1 Planck volume, it would nonetheless be too big to fit in the observable universe) and note that if s in the limit $e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)} \left(\left(\frac{1}{e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}}\right)^{\frac{1}{s+1}}\right)^{s+1}$

differs from 1 by as little as

$$1^{-g}$$

the number of primes in the progression associated to $\left(\frac{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2}{e^{2\gamma}\left(e^{\frac{1}{s-1}-\zeta(s)}\right)^2 - e^{2\gamma}\left(\exp\left(-\left(\sum_{n=1}^{x}\frac{1}{n^s} - \int_1^x \frac{1}{n^s}\,dn\right)\right)\right)^2}\right)^{1/s}$ is finite. This mathematics extends the inverse square law beyond the arithmetically continuous classical domains in which there is a balance of energy-density and sparsity by regarding non-classical regions as sub or super-domains. Note that where s > 1 the traditional value of π (written as $e^{(s+1)\left(\zeta(s)-\frac{1}{s-1}\right)}$ where $s = 1$) is effectively distorted in positive direction, thereby distorting the dimensions of a circle in a certain direction. Where s < 1, this value is distorted in a *negative* direction, also distorting the dimensions of a circle. In the one case, there is an imbalance of energy and space in favour of energy, while in the other, the imbalance is in favour of space. If we take the unit in which fundamental physical constants are encapsulated and attach it to the $\frac{S}{\pi r^2}$ equation like this:

$$S = \sqrt[12]{\frac{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2}{e^{2\gamma}\left(e^{-\left(\zeta(12)-\frac{1}{12-1}\right)}\right)^2 - e^{2\gamma}\left(e^{-\left(\sum_{n=1}^{x}\frac{1}{n^{12}} - \int_1^x \frac{1}{n^{12}}\,dn\right)}\right)^2}}$$

$$\frac{S}{\pi r^2} \approx \lim_{x\to\infty} \frac{S}{e^{2\left(\sum_{n=1}^{x}\frac{1}{n} - \int_1^x \frac{1}{n}\,dn\right)} r^2} = \frac{S}{e^{2\gamma} r^2}$$

we see that, while the classical objects ($s = 1$) that are the “flux” of this energy system are governed by the inverse square law, and the non-classical objects (s ≠ 1) that are the *sources of this flux* are not, both are nonetheless governed by the same equation.

References

A. [1] Feynman, R (1985), *QED: The Strange Theory of Light and Matter*

B. [2] Johnson, H (2010), *Changes spotted in fundamental constant*

C. [3] Webb, J (2010), *Evidence for the spatial variation of the fine-structure constant*

D. [4] King, J (2010), *Searching for variations in the fine-structure constant and the proton-to-electron mass ratio using quasar absorption lines*

E. [5] O'Connor, J (1996), *General relativity*

F. [6] Wald, R (1997), *Gravitational Collapse and Cosmic Censorship*

G. [7] Wald, R (1984), *General Relativity*

H. [8] Rubin, V et al (1980), *Rotational Properties of 21 Sc Galaxies with a Large Range of Luminosities and Radii from NGC 4605 (R = 4kpc) to UGC 2885 (R = 122kpc)*

I. [9] Davenport, H (2000), *Multiplicative number theory*

J. [10] Graham, R (1971), *Ramsey's Theorem for n-Parameter Sets*