New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

Author Michael John Sarnowski; Email thilel@charter.net

I. Abstract

Eddington believed that the number of particles in the universe was equal to the fine structure constant multiplied by two to the power 256. Paul Dirac(5) proposed a Large Number Hypothesis (LNH) that related very large unexplained and relatively consistent numbers in physics. This paper will show that Eddington and Dirac may have been very close to the truth. In addition it will show the number of particles in the elementary particles and it is also related to the fine structure constant and two to the power of 128.

In “Planck Pressure and Force between two Hubble Sphere Universes are equivalent and Provide Evidence for Multiple Hubble Sphere Universes and Rigid Components of Space”(1) a Critical Mass of the Universe is calculated. This equation can also be used to estimate a total amount of particles in the universe. The estimated mass of the Universe is used here to estimate the number of particles and a possible relation to the Eddington number(2) by the fine structure constant.

In “Discrete Calculations of Charge and Gravity with Planck Spinning Spheres and Kaluza Spinning Spheres”(3) a value “N” of 6.57943*10^40 was calculated for the number of spheres that give rise to the mass of the Planck Spinning Sphere, which it is proposed, that the Planck Spinning Sphere is made of many smaller spheres called Kaluza Spinning Spheres, and it is also proposed that the Universe is made of Planck Spinning Spheres make up the Universe all packed in a mostly cuboctahedron structure. The value “N” will be shown to be possibly related to 2^128 and the fine structure constant.

II. Calculation of the number of particles in the Universe

This section uses two different methods to approximate the number of particles in the universe with the assumption that most particles are protons and electrons. One method is to take the mass of the Universe as calculated in “Planck Pressure and Force between two Hubble Sphere Universes are equivalent and Provide Evidence for Multiple Hubble Sphere Universes and Rigid Components of Space”(1) and another method is to use an equation similar to the Eddington number calculation. These calculations are summarized below.
New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

From “Planck Pressure and Force between two Hubble Sphere Universes are equivalent and Provide Evidence for Multiple Hubble Sphere Universes and Rigid Components of Space”(1) Equation 3.3

Equation 2.0 \[ \text{Critical Mass of Hubble Sphere Universe} = \frac{3h^2 c^2 \pi^3}{2G^2 M_{n}^3} = 8.76906 \times 10^{52} \text{ kg} \]

When the Critical Mass of the Hubble Sphere Universe is divided the mass of the Proton and Electron added and multiplied by two one comes up with a number \( N \). The two is used since the proton and electron would be two particles. This number is as follows.

Equation 2.1

\[
N_{\text{particles of the Universe}} = \frac{3h^2 c^2 \pi^3}{G^2 (M_{p} + M_{e}) M_{n}^3} = 1.047974 \times 10^{80} \text{ protons and electrons}
\]

Using an Eddington similar equation, where Eddington used \( 2^{256} \) multiplied by the fine structure constant we will use a similar equation.

Equation 2.2

\[
N_{\text{particles of the Universe}} = \alpha^{-1.5} \frac{2^{256}}{\pi^{0.5}} = 1.047987155 \times 10^{80}
\]

The ratios of the \( N \) particle calculations in Equation 2.1 and 2.2, are within 0.99998 of each other, and this is well within the Codata significant figures for the gravitational constant.

Interestingly, the square root of \( \pi \) seems like a magic numerology number, however, when one looks at the value of the alternate value for the fine structure constant shown in “Discrete Calculations of Charge and Gravity with Planck Spinning Spheres and Kaluza Spinning Spheres”(3) equation 4.0, equation 2.3 here;

Equation 2.3 \[ \left[ (e^2) * \frac{1}{h+c+2+e} \right] / \left[ T * (\pi^3) * \frac{M_{e}}{4M_{n}} \right] = 1 \]

One can see that the value for \( \alpha \) or inverse of \( \alpha \), the fine structure constant, is also

Equation 2.4 \[ \text{fine structure constant} = \alpha = T \pi^3 \frac{M_{e}}{4M_{n}} \]
New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

Where Me is the mass of the electron, Mn is the mass of the Neutron, Mp is the mass of the proton and

\[ T^2 = \frac{((Mp - Me)^2 + Mn^2 + Mn^2)}{Mn^2} \]

So in equation 2.0 above, with the alternative formulation of the fine there is a square root of pi in two places in the denominator. When equation 2.4 is substituted into equation 2.2 for the fine structure constant it becomes.

Equation 2.5 \( N_{\text{particles of the Universe}} = \left( \frac{4Mn}{T^2 \pi^3 Me} \right)^{1.5} \frac{2^{256}}{\pi^{0.5}} = 1.047987155 \times 10^{80} \)

Which simplifies to

Equation 2.6 \( N_{\text{particles of the Universe}} = \left( \frac{4Mn}{TMe} \right)^{1.5} \frac{2^{256}}{\pi^{5}} = 1.047987155 \times 10^{80} \)

This cancelling of the \( \pi^{0.5} \) lends credence both to the alternative definition of the fine structure constant in equations 2.3, 2.4 and the Eddington calculation itself in equation 2.5.

The number N, from equation 2.6, when back calculated into

Equation 2.1

\[ N_{\text{particles of the Universe}} = \frac{3h^2 c^2 \pi^3}{G^2 (M_p + Me) Mn^3} = 1.047974 \times 10^{80} \ \text{protons and electrons} \]

gives a value for the gravitational constant of

\[ G = 6.673798 \times 10^{-11} \]

III. Calculation of the number of particles of mass in the Planck Spinning Sphere.

In “Discrete Calculations of Charge and Gravity with Planck Spinning Spheres and Kaluza Spinning Spheres”(3) the Planck Spinning Sphere is defined as follows

Kaluza Spinning Sphere (Kaluza)— Planck Spinning Sphere (Planck)- This model works with the idea that there are levels of spheres that make up the Universe, Multiverse, and the Planck Spinning Sphere. There may and probably are levels of spheres besides these. The Kaluza Sphere would be made of the next smaller spheres called Kline Spinning Spheres (Kline). The spheres go in this order. Approximately \( 10^{30} \) klein spheres make up a Kaluza sphere, approximately \( 10^{60} \) Kaluza spheres make up the
New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

Planck Sphere, approximately $10^{121}$ Planck Spheres make up the universe, and approximately $10^{242}$ universes make up the multiverse. All spheres are essentially equal within their domain.

In the paper noted above a value $N$ is calculated to be in equation 3.0 in the above mentioned paper and equation 3.0 in this paper as well. This equation is noted below

Equation 3.0  \[ N = \frac{2\pi^3hc}{G(M\kappa)^2} = 6.57943 \times 10^{40} \]

If one substitutes the value for $G$ derived in equation 1.0 in “Calculation of the Gravitational Constant”

Equation 3.1  \[ G = \frac{3h^32^7\pi^4}{M\kappa^3c^3BM\kappa} \]

Where  \[ B^2 = \frac{(M\kappa - Me)^2 + M\kappa^2}{M\kappa^2} = 1.999064866 \]

\[ B = 1.413882904 \]

Then we come up with equation 3.2 for $N$ of

Equation 3.2  \[ N = \frac{Mnc^4BM\kappa}{3h^22^6\pi} = 6.579631 \times 10^{40} \]

One can also use an Eddington similar calculation to come up with a number of particles in the universe. This equation is as follows

Equation 3.3  \[ N = \alpha^{-1}B \times 2^{128} = 6.592817 \times 10^{40} \]

Although these numbers are not within the codata of the gravitational constant they are very close. What the exact mechanism is, that could be employed to bring these numbers closer is not known. The following is one dimensionless number that could modify equation 3.3.

\[ S^2 = \frac{((M\kappa - Me)^2 + (M\kappa - Me)^2 + (M\mu - Me)^2)}{(M\kappa)^2} = 2.993988032 \] which gives $S=1.730314431$

Equation 3.4  \[ N = \frac{S^2\alpha^{-1}B \times 2^{128}}{3} = 6.5798556 \times 10^{40} \]

The number $N$, from equation 3.4, when back calculated into

Equation 3.0  \[ N = \frac{2\pi^3hc}{G(M\kappa)^2} = 6.5798556 \times 10^{40} \] gives a value for the gravitational constant of $G = 6.673413 \times 10^{-11}$. 
New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

IV. Discussion

Do the calculation in 2.0 and 3.0 prove that Eddington was almost right. No it does not. The numbers are coincidentally and or are a reflection of reality. The theoretical basis for the Eddington hypothesis is not known. However, that these numbers are much more close than what Eddington had access to, it suggests that development of a working theory for using powers of $2^{128}$ and $2^{256}$ with the fine structure is worth looking into further. In addition to Eddington, Paul Dirac(4) worked on a similar vein of work called the large number hypothesis.

Although Dirac and Eddington’s work in this area of large numbers and Eddington number are called Numerology today. It may be time to look into these hypotheses again as other theories of quantum foam, and string theory, the standard model, quantum mechanics, general theory of relativity, quantum electrodynamics, quantum chromodynamics, and others have failed to come up with a complete theory and or an actual mechanism that explains what the universe is made of.

It should be noted that, Sir Arthur Eddington, the one who helped confirm Einstein’s general theory of relativity, was one of the foremost astrophysicist’s of the twentieth century(5). It should also be noted that Paul Dirac(6) was noted for many famous accomplishments including equations that predicted the positron. Today, if these two people were to make the predictions of the Eddington number and large number hypothesis, their whole reputation would be annihilated and the rest of their work would never have been looked at.

Appendix A

Fundamental Physical Constants (18)
1. $c=2.99792458 \times 10^8 \text{ m/s}$
2. $h=6.62606957(33) \times 10^{-34} \text{ J s}$
3. $G=6.67384(80) \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$
4. Mass of Neutron = $Mn=1.674 927 351(74) \times 10^{-27} \text{ kg}$
5. Mass of Proton = $Mp=1.672 621 777(74) \times 10^{-27} \text{ kg}$
7. Inverse Fine Structure constant = $\alpha^{-1}=137.035999074(44)$
New Evidence for the Eddington Number, the Large Number Hypothesis, and the Number of Particles in the Universe.

V. References

2.) http://en.wikipedia.org/wiki/Arthur_Eddington#Eddington_number_.28cycli ng.29
4.) http://en.wikipedia.org/wiki/Paul_Dirac
5.) http://www2.lowell.edu/users/jch/mtb/e.html