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Planck's Atom (Rev. 1.1)

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0. Introduction

The purpose of this paper is to:

1) *Describe Planck's Atom*

2) *Define Newton's Gravitational Constant 'G'*

*(Refer to **Appendix 1** for an explanation of the mathematical formulas, constants, symbols and units used in this document)*

1. Conclusions

Planck's atom has been successfully described using Planck's own formulas and in such a way as to mirror the formulas used to describe a standard atom.

Together with the constant 'φ' (Claim 2), Planck's atom may be used alongside Newton's and Coulomb's theories to describe electron behaviour, and thereby form the basis of a general theory for the unification of atomic and sub-atomic particles; i.e. a Newtonian atom

1.1 Further Work

A second verification for G is recommended, although not considered necessary by the author

2. The Planck System

Planck constructed his three formulas (Appendix 2) such that Newton's gravitational constant could form part of the definition of an atom including the properties of its component parts; i.e. proton and electron. As such, it is the author's opinion that Planck believed Newtonian mechanics could be used to describe atomic particles.

3. Methodology

1) Confirm Planck's theories in that they can be manipulated to define G (Appendix 2)

2) Develop Planck's three basic theories (m, t & λ) to create two new Planck theories to describe energy (E) and force (F) in the same form as his original three

3) Establish factors for Planck's atom (Table 2)

4) Check accuracy of CalQlata's and Codata's estimates for 'G'

5) Correct 'G' to eliminate calculation errors

4. Calculation Results

Planck's formulas (Appendix 2) are used to calculate his electron properties first with 'ħ' for the standard atom and again with '$\hbar_\varrho$' (Appendix 1) for the Planck atom, the results from which are summarised below:

Property	Values using Planck's constant '$\hbar_\varrho$': A	Values using Planck's constant 'ħ': B	Ratio A/B
t (s)	1.48432887846076E-34	5.39096122598358E-44	*2753365895.68949*
λ (m)	4.44990604438463E-26	1.61616952231127E-35	*2753365895.68949*
m (kg)	59.9283854507007	2.17655000174590E-08	*2753365895.68949*
E (J)	5.38609471364750E+18	1.95618559889903E+09	*2753365895.68949*
F (N)	1.21038391820525E+44	1.21038391820525E+44	1.0

Table 1: Planck's Values

Note:

E = 2.**KE**[(1)] .φ; which means that Planck's energy must be gravitational (Newtonian)

t = **λ.(m/E)**$^{0.5}$; so it too must be gravitational (Newtonian)

[(1)] *Appendix 3, Table 3, Shell 2π*

The above ratios reveal that G = 6.67359232004332E-11 N.m²/kg² must be correct because:

All four ratios (A/B) = *2753365895.68949* ***exactly*** equals $(\hbar_\varrho/\hbar)^{0.5}$ and shows that Planck's constants vary with mass;

and a value of ***exactly*** 1.0 for Ratio (F) also shows that Planck's gravitational force and Newton's gravitational force may be calculated using conventional Newtonian theory.

Using **CalQlata**'s original estimate of 'G' (6.67128190396304E-11) for the above calculations ...
Ratios = *2752650947.59247* & *2753604252.98478* neither of which ≠ $(\hbar_\varrho/\hbar)^{0.5}$
(errors = -0.000173116364635351 & 0.00017314633910015)
and
Force Factor: 1.00034632265785 (error = 0.00034632265785)

Using **Codata**'s estimate of 'G' (6.674E-11) for the above calculations ...
Ratio: *2753492044.03629* & *2753323847.52487* neither of which ≠ $(\hbar_\varrho/\hbar)^{0.5}$
(errors = 0.000030543799439231 & -0.000030542866544137)
and
Force Factor: 0.99993891519978 (error = -0.00006108480022)

Planck's Atomic Particle

All the particles in a Planck atom are identical in size and substance to each other.

Newton's and Planck's atomic particles share a commonality in the product of their volumes:
$V_\varrho.V_e$ = 3E-91 (*exact*) for both Newton's and Planck's atomic particles where: V_ϱ is the volume of the force-centre and V_e is the volume of the satellite

The radius (R^P) of a Planck particle can therefore be calculated thus;
$R^P = \sqrt[6]{[9 \times 3E\text{-}91 \div 16\pi^2]}$ = 5.07563837996471E-16 m
and $V^P = V_\varrho = V_e = {}^4/_3\pi.R^{P3}$ = 5.47722557505167E-46 m³

As Planck's mass; $m^P = 2.1765500017459E\text{-}08$ kg
Planck's density; $\rho^P = m^P/V^P = 3.97381844498046E\text{+}37$ kg/m³

Planck-Newton Commonality

$F^P = c^4/G = 299792459^4 / 6.67359232004334E\text{-}11 = 1.21038391820525E\text{+}44$ N

$F^N = G.m_\varrho.m_e/a_o^2 = 3.63115175E\text{-}47$ N

$F^N/F^P = 3E\text{-}91$ (*exact*)

Therefore; $F^N/F^P \equiv V^N_\varrho.V^N_e = V^P_\varrho.V^P_e = 3E\text{-}91$ (*exact*)

5.1 Claims

Claim 1: Newton’s Gravitational Constant; $G = 6.67359232004332E\text{-}11$ N.m²/kg²

Claim 2: Universal factor for Coulomb’s and Newtons’s coupling forces: $\varphi = 4.40742111792333E\text{-}40$

Claim 3: Planck’s theories could form the basis for the unification of atomic and sub-atomic theories

Appendices

Appendix 1: Mathematical Constants, Formulas, Symbols & Units

Appendix 2: Planck’s Formulas

Appendix 3: Planck’s Atom (properties)

Appendix 1: Mathematical Symbols & Units

The following Table, which should be read in conjunction with our Rydberg Atom page, contains modified constants used in the calculations for the Planck atom values:

The values for the standard atom have been taken from CalQlata's web page; http://calqlata.com/Maths/Constants.html

Sym (units)	Formula	Planck Atom Values	Rydberg Atom Values
G (C/mol)		6.67359232004332E-11	6.67359232004332E-11
F (C)	$= e.N_A$	96485.3317942158	5.38005167559927E+25
m_1 (kg)	$= (\hbar.c/G)^{0.5}$	2.1765500017459E-08	1.67262163783E-27
m_2 (kg)	$= (\hbar.c/G)^{0.5}$	2.1765500017459E-08	9.1093897E-31
h (J.s)	$= (\pi.m_2.a_o.e^2 / \varepsilon_0)^{0.5}$	5.02324073024593E-15	6.62607174469163E-34
ħ (J.s)	$= h / 2\pi$	7.99473592559182E-16	1.05457207144921E-34
ε_0 (s²/m²)	$= 1 / \mu_0.c^2$	8.85418775855161E-12	8.85418775855161E-12
μ_0	$= 4\pi / 1E+07$	1.25663706143592E-06	1.25663706143592E-06
N_A		6.02214129E+23	6.02214129E+23
c (m/s)		299792459	299792459
e (C)	= Q	89.3378520449704	1.60217648753E-19
k (N.m²/C²)	$= 1 / 4\pi.\varepsilon_0$	8987551847.32667	8.98755184732667E+09
R_γ (J)	$= R_\infty.h.c.(Z/n)^2$	8.76103166894037E+49	2.17987197684936E-18
R_γ (eV)	$= e / R_\gamma$	9.80662895782438E+47	13.605691968492
R_∞ (/m)	$= m_2.e^4 / 8.\varepsilon_0^2.h^3.c$	5.8176897123571E+55	1.09737269561359E+07
PE (J)	$= -k.e^2 / a_o$	-1.75220633378807E+50	-4.35974395369872E-18
a_o (m)	$= \lambda / (2\pi)^2$	4.0938052242E-37	5.2917721067E-11
Q (C)	= Q	89.3378520449704	1.60217648753E-19
Q (J)	$= (G.m_1.m_2 / k.\varphi)^{0.5}$	89.3378520449704	1.60217648753E-19
φ	$= F_g/F_e$ #	4.40742111792333E-40	4.40742111792333E-40
Table 2: Constants			

Universal factor: $\varphi = F_g/F_e = G.m_1.m_2 / R^2 \div k.Q_1.Q_2 / R^2 = G.m_1.m_2 / k.Q_1.Q_2$ = 4.40742111792333E-40

Refer to CalQlata's **Definitions** (http://calqlata.com/help_definitions.htm) for an explanation of the terms used in this paper

Appendix 2: Planck's Formulas

Planck's original formulas are as follows:

Planck's time; $t_\varrho = (\hbar.G / c^5)^{0.5}$

Planck's length; $\lambda_\varrho = (\hbar.G / c^3)^{0.5}$

Planck's mass; $m_\varrho = (\hbar.c / G)^{0.5}$

Planck's additional formulas as defined by the author are as follows:

Planck's energy; $E_\varrho = (\hbar.c^5 / G)^{0.5}$

Planck's force; $F_\varrho = c^4 / G$

From the above and;

$\hbar = h / 2\pi$

$v = 2\pi R/t$

$\lambda = h / m.v$

we can establish the following for a Planck atom:

$(\hbar.G/c^3)^{0.5} = h \div (\hbar.c/G)^{0.5} \div 2\pi R/t$

$(\hbar.G/c^3)^{0.5} = h \div 2\pi R \text{ x } t \div (\hbar.c/G)^{0.5}$

$(\hbar.G/c^3)^{0.5} = \hbar/R \text{ x } (\hbar.G/c^5)^{0.5} \div (\hbar.c/G)^{0.5}$

$\hbar.G/c^3 = \hbar^2/R^2 \text{ x } \hbar.G/c^5 \div \hbar.c/G$

$\hbar.G/c^3 = R^2.\hbar^2 \text{ x } \hbar.G/c^5 \text{ x } G/\hbar.c$

$G/c^3 = G^2.\hbar / R^2.c^6$

$R^2 = G.\hbar / c^3$

$R = (G.\hbar/c^3)^{0.5} = \lambda$ {$\lambda = 2.\pi.R/n$ for non-Planck values}

i.e. in Planck's atom, the radius of separation between its nucleus and its orbiting mass is equal to its wavelength, and its shell number is equal to $2.\pi$

moreover, if $R = \lambda$ in Planck's atom;

$G = \lambda^2.c^3 / \hbar$

from which; G = 6.67359232004332E-11 using Rydberg Atom Values (see **Appendix 1**) verifying the above **formula**, however, regarding its units:

$m^2 \text{ x } m^3/s^3 \div J.s = m^2 \text{ x } m^3/s^3 \div kg.m^2.s/s^2 = m^5 /m^2 \text{ x } s^2/s^4 \div kg = m^3 \div kg.s^2$

are missing; kg/kg

i.e. $kg/kg \text{ x } m^3 \div kg.s^2 = kg.m/s^2 \text{ x } m^2/kg^2 = N.m^2/kg^2$

In order to create the correct units we need to apply the mass ratio m_1 / m_2 , which in the Planck atom equals 1.0

Appendix 3: Planck's Atom (properties)

The following Tables contain the formulas and properties of a Planck electron in the specified shells (n) orbiting a single Planck proton (Z=1) using the same formulas for a Rydberg Atom and the above constants.

Shell	$KE = R_\gamma.(Z/n)^2$ $= m_e.R.(2.\pi/t)^2$ $= m_e.h^2 / R^3$	$PE = -2.KE$ $= -h.f$ $= -m_e.v^2$	$E = KE+PE$ $= -KE$
	(J)	(J)	(J)
1	8.76103166894037E+49	-1.75220633378807E+50	-8.76103166894037E+49
2π	**2.21919524656261E+48**	-4.43839049312522E+48	-2.21919524656261E+48

Table 3: Kinetic, Potential and Total Energies in an Atom with one Proton and One Electron

Shell	$v = 2.KE / m_e$ $= 2.\pi.R / t$ $= \sqrt{[k.Q_1 .Q_2 / m_e.R]}$	$R = a_o.n^2 / Z$	$t = v.R$ $= n.h / 2.R_\gamma$ $= n^3 / 2.Z^2.c.R_\infty$ $= n^3 . [\pi.a_o]^{1.5}$. $[16.\varepsilon_0 .m_e]^2 / e$ $= n.\lambda / v$
	(m/s)	(m)	(s)
1	8.97239322207392E+28	4.09380522418125E-37	2.86680891021906E-65
2π	1.42800073265728E+28	1.61616952231127E-35	7.11112562078409E-63

Table 4: Orbital Velocities, Radii and Periods

Shell	$h = R.v$	$p = m_e.v$
	(m^2/s)	(kg.m/s)
1	3.67312302459346E-08	1.95288624831699E+2
2π	2.30789126195887E-07	3.10811499715836E+20

Table 5: Newton's Motion Constants and Momenta

Shell	$\lambda = 2\pi R / n$ $= p / h$	$f = v / \lambda$
	(m)	(Hz)
1	2.57221368350306E-36	3.48819900913307E+64
2π	1.61616952231127E-35	8.83571130963482E+62

Table 6: Electron Wavelengths and Frequencies

Shell	$Fg = G.m_1 .m_2 / R^2$ $= G.m_1 .m_2 / R^3.(2.\pi/t)^2$	$F_e = k.Q_1 .Q_2 / R^2.\varepsilon$	$\varphi = Fg/F_e$ $= G.m_1 / R.(2.\pi.R/t)^2$ $= G.m_1 / R.v^2$ $= G.m_1 .R / h^2$
	(N)	(N)	
1	1.88643835639276E+47	4.28014093938363E+86	4.40742111792333E-40
2π	1.21038391820525E+44	2.74624068320377E+83	4.40742111792333E-40

Table 7: Gravitational and Electrostatic Electron Holding Forces and their ratio (φ)

Shell	$KE_n\text{-}1/KE_n - 1 = [n/(n-1)]^2 - 1$	$KE_1 /KE_n - 1 = n^2 - 1$
1		
2π	38.4784176043574 38	38

Table 8: Kinetic Energy Jump Factors Between Shell Numbers (n)
n=1 to n: $KEn = KE_1 / n^2$
n-1 to n: $KEn = KEn\text{-}1 . [(n-1)/n]^2$