Appendix 1

1. Derived equations:

Notes: 1. The equation numbering is the same as in BSM. The first digit shows the Chapter's number.

2. Equations (3.13.a), (3.21.a) and (3.42.F), known from the modern physics, are derivable also from the BSM theoretical models.

$$R_c = \frac{c}{2\pi\nu_c} \qquad (3.13.a)$$

$$s_e = \frac{\alpha c}{\nu_c\sqrt{1-\alpha^2}} \quad \text{Helical step} \qquad (3.13.b)$$

$$r_e = s_e/g_e \quad \text{small electron radius} \qquad (3.13.c)$$

$$r_p = \frac{2}{3}r_e \quad \text{small positron radius} \qquad (3.13)$$

$$c = \frac{\nu_R d_{nb}}{k_{hb}} \quad [\text{m/s}] \quad \text{light velocity} \qquad (2.75)$$

where: $k_{hb} = \sqrt{1 + 4\pi^2(0.6164^2)} = 4$ (2.20.a)

$$\mu_o = \frac{4\pi m_{CL} k_{rd}^2 c \nu_c^3}{N_{RQ}} \quad \left[\frac{N}{A^2}\right] \qquad (2.52)$$

$$\varepsilon_o = \frac{N_{RQ}}{4\pi m_{CL}\nu_c^3 c^3 k_{rd}^2} \quad \left[\frac{C^2}{Nm^2}\right] \qquad (2.53)$$

$$h = \frac{\pi(c)c^2 m_{CL} N_{RQ}^3 k_d}{4\nu_c k_{hb}^3} \quad [\text{N m s}] \quad \text{where: } k_d = \frac{\tau_{511KeV}}{\tau_{CL}} \qquad (2.58)$$

$$q = \frac{N_{RQ}^2}{2\nu_c^2}\sqrt{\frac{c\alpha k_d}{2k_{rd}^2 k_{hb}^3}} \quad [\text{C}] \qquad (2.58.a)$$

$$P_S = \frac{g_e^2 h\nu_c^4(1-\alpha^2)}{\pi\alpha^2 c^3} \quad \left[\frac{N}{m^2}\right] \qquad (3.53)$$

$$\rho_e = \frac{m_e}{V_e} = \frac{g_e^2 h\nu_c^4(1-\alpha^2)}{\pi\alpha^2 c^5} \quad \left[\frac{kg}{m^3}\right] \qquad (3.55)$$

$$P_D = \frac{g_e h\nu_c^3\sqrt{1-\alpha^2}}{2\pi\alpha c^3} \quad \left[\frac{N}{m^2}\right] \qquad (3.62)$$

$$m = \frac{g_e^2 h\nu_c^4(1-\alpha^2)}{\pi\alpha^2 c^5}V \quad [\text{kg}] \quad \text{- mass equation} \qquad (3.57)$$

$$\sigma = \frac{\nu_c\alpha^2}{2c} = 1.09737315\times10^7 \quad [(\text{m}^{-1}] \qquad (3.21.a)$$

$$\gamma = (1 - V^2/c^2)^{-1/2} \qquad (3.42.F)$$

$$T = \frac{N_A^2}{S_w}\frac{h\nu_c(R_c + r_p)^3 L_{pc}^2}{2cR_c r_e R_{ig}}\left(\frac{\mu_e}{\mu_n}\right) \quad [\text{K}] \qquad (5.6)$$

$$T = \frac{N_A^2 hc^2\left(3g_e\sqrt{1-\alpha^2} + 4\pi\alpha\right)^3}{864\alpha^3\nu_c^2\pi^2 g_e^2(1-\alpha^2)R_{ig}}\frac{\mu_e}{\mu_n} \quad [\text{K}] \qquad (5.12)$$

$$E_{ZPE} = \frac{1}{2}m_{in}r_{abcd}^2(4\pi^2\nu_R^2) \quad [\text{J/node}] \qquad (5.13)$$

$$r^2 = b^2(1 - a^2(\sin(\theta))^2) \qquad (6.54)$$

$$L_{pc} = \left[\left(\frac{\mu_e}{\mu_\mu}\right)^2(4\pi^2R_c^2 + s_e^2) - 4n^2\pi^2R_\pi^2\right]^{1/2} \qquad (6.61)$$

$$E = \frac{2q}{4\pi\varepsilon_0[L_q(1) + 0.6455L_p)]} = 16.01 \text{ eV} \quad \text{for } H_2 \text{ ortho} \qquad (9.4)$$

$$C_{IG} = (2h\nu_c + h\nu_c\alpha^2 + 6.26q)(L_q(1) + 0.6455)L_p) \qquad (9.17)$$

where: $C_{IG} = G_0 m_{n0}^2$

$$E_V = \frac{C_{IG}}{q[[[L_q(1)](1-\alpha^4\pi\Delta^2)] + 0.6455L_p]^2} - \frac{2E_q}{q} - \frac{2E_K}{q} \qquad (9.23$$

$$\Delta r = L_q(1)\alpha^4\pi\Delta^2 \quad [\text{m}] \qquad (9.26)$$

$$\Delta E(p, n, \Delta) = \frac{2\alpha C_{IG}(A-p)^2}{[r_n \pm [\Delta r(n,\Delta)]]^2} - pB_{D2}(n,\Delta) \qquad (9.55)$$

$$P_P/P_S = \alpha^2/\sqrt{1-\alpha^2} \qquad (10.18)$$

$$p_p = \alpha c\rho_e = \frac{g_e^2 h\nu_c^4(1-\alpha^2)}{\pi\alpha c^4} = 2.19\times10^{-25} \quad \left[\frac{N \sec}{m^3}\right] \qquad (10.22)$$

$$E_{IFM} = P_P V_e = h\nu_c\frac{v}{c}\alpha \qquad [Nm] \equiv [J]$$

$$E_{IFM}^G = E_{IFM}\frac{\sqrt{U_{Gn}}}{2\alpha c} \qquad [J] \qquad (10.59)$$

$$r = \tilde{L}\frac{\ln(z+1)}{\ln(\tilde{n})} \qquad [\text{m}] \qquad (12.50)$$

$$\tilde{n} = \exp\left(\frac{1}{(dN/\text{dz})(z+1)}\right) \qquad (12.52)$$

2. Notations:

Derived equations ***Table 1***

Eq. No	Parameter	Name
(3.13.a)	R_c	Compton radius of electron
(3.13.b)	s_e	helical step of the electron
(3.13.c)	r_e	small electron's radius
(3.13)	r_p	small positron's radius
(2.75)	c	light velocity by resonance CL node param
(2.52)	μ_o	permeability of free space
(2.53)	ε_o	permittivity of free space
(2.58)	h	Planck's constant by CL space parameters
(2.58.a)	q	unit charge by CL space parameters
(3.53)	P_S	Static CL pressure
(3.55)	ρ_e	Intrinsic electron density estimated by the Newtonian mass
(3.62)	P_D	Dynamical CL pressure
(3.57)	m	Newtonian mass of helical structure particle
(3.21.a)	σ	Rydberg constant by CL space parameters
(3.42.F)	γ	Relativistic gamma factor (derived from the electron quantum motion
(5.6)	T	CL space background temperature (by e^- param)
(5.12)	T	CL space background temperature (by CL space parameters)

Note: The calculated parameter T is for the Earth local field

(5.13)	E_{ZPE}	Zero Point Energy of single CL node
(5.14)	$E_{ZPE}(1m^3)$	ZPE in 1 vacuum m^3
(6.54)		Hippoped curve in polar coordinates
(6.61)	L_{pc}	Length of proton (neutron) core
(9.4)	E	Calculated energy potential for H_2 ortho-I, corresponding to experimental value of EVIP from PE spectrum
(9.17)	C_{IG}	Product of IG constant and quadrature of intrinsic proton mass (Intrinsic product)
(9.55)	$\Delta E(p, n, \Delta)$	Equation for vibrational levels for diatomic homonuclear molecules, where: A - is the atomic mass in atomic mass units (for one atom); p - is the number of protons involved in the bonding system (per one atom); n - is a subharmonic quantum number of the quantum orbit; r_n - is the internuclear distance at the equilibrium; Δr - is a deviation from the equilibrium point; Δ - is a vibrational quantum number, referenced to equilibrium
(9.26)	Δ r	Range of vibrational motion of protons in H_2 ortho-1 molecule
(10.11)	E_{IFM}	Inertial force moment of folded CL nodes
(10.18)	P_P/P_S	Ratio between Partial and Static CL pressure
(10.22)	p_p	Specific partial pressure of CL space
(9.23)	E_V	Energy levels of H_2 ortho-I molecule
(10.59)	E^G_{IFM}	Inertial force moment in gravitational field
(12.50)	r	cosmological distance between distant galaxies where: z - redshift; L - mean intergalactic distance;
(12.52)	n	mean quasirefractive index of GSS; where: (dN/dz) is a line density measurable from Lyman alpha forests

3. Used physical constants ***Table 2***

Constant		Name
$\alpha = 7.29735308\times10^{-3}$		fine structure constant
$c = 2.9979245\times10^{8}$	(m/s)	light velocity
$\nu_c = 1.2355898\times10^{20}$	(Hz)	Compton's frequency
$h = 6.6260755\times10^{-34}$	(J.s)	Palnck's constant
$q = 1.60217733\times10^{-19}$	(C)	elementary charge
$\mu_0 = 4\pi\times10^{7}$	(N/A^2)	permeability of free space
$\varepsilon_0 = 8.8541878\times10^{-12}$	(C^2/N m^2)	permittivity of free space
$g_e = 2.0023193$		electron's gyromagnetic factor
$\mu_e = 9.2847701\times10^{-24}$	(A m^2)	electron's magnetic moment
$\mu_n = 9.6623707\times10^{-27}$	(A m^2)	neutron's magnetic moment

Notes: (1) Additionally to the above constants, the rest masses of elementary particles as: proton, neutron, electron, pions, muon, kaon are used. Two parameters from Electroweak theory also are used - the Fermi coupling constants, G_F and the effective mixing parameter θ^{lept}_{eff} . The measured mass equivalent energies of the bosons and tau are also used.

(2) Large observational data material used by BSM is not listed in the abstract paper.

4. Calculated parameters *Table 3*

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Parameter Name

$R_c = 3.8615932 \times 10^{-13}$ (m) Compton radius of electron

$s_e = 1.77061164 \times 10^{-14}$ (m) helical step of the electron

$r_e = 8.842805 \times 10^{-15}$ (m) small radius of the electron

$r_p = 5.895203 \times 10^{-15}$ (m) small radius of the positron

$L_{pc} = 1.6277 \times 10^{-10}$ (m) - proton's (neutron's) core length

$L_P = 0.667 \times 10^{-10}$ (m) - proton's length

$W_P = 0.19253 \times 10^{-10}$ (m) - proton's width

$2(R_c + r_p) = 7.841 \times 10^{-13}$ (m) - proton's core thickness

$N_{RQ} = 0.88431155 \times 10^{9}$ number of resonance cycles contained in one SPM cycle

$\tau_{CL} = 0.0242631 \times 10^{-10}$ (s) space-time constant of CL space

$k_d = 51.518$ ratio between the CL pumping time for 511 KeV photon and the space-time const

$k_{hb} = \sqrt{1 + 4\pi^2(0.6164^2)} = 4$ - derived from the concept of wavetrain width and Airy disk in diffraction limited optics (Eq. 1.20.a)

$d_{nb} = 1.0975 \times 10^{-20}$ (m) *xyz* node distance of CL space

$k_{rd} = 0.15$ equivalent trace radius of vibrating MQ type of node normalized to a node distance

$m_{CL} = 6.94991 \times 10^{-66}$ (kg) inertial mass of the CL node estimated from Eq. (2.58)

$T = 2.6758$ (K) CL space background temperature for the Earth local field

$C_{IG} = 5.276867 \times 10^{-33}$ (N m)

$E_{ZPE} = 4.43867 \times 10^{-48}$ (J/node) - ZPE of single CL node

$E_{ZPE}(1m^3) = 3.35776 \times 10^{12}$ (J/m3) - ZPE in 1 m^3 space

$P_S = 1.3735811 \times 10^{26}$ (N/m^2) - Static CL pressure

$\rho_e = 1.52831 \times 10^{9}$ (kg/m^3) - intrinsic electron density

$P_D = 2.0257865 \times 10^{3}$ (N/m^{2}Hz) - Dynamical CL pressure

$E = 16.06$ (eV) - theoretically derived system energy, corresponding to $E_{VIP} = 15.967$ eV from PE spectrum

$C_{IG} = 5.26511 \times 10^{-33}$ - intrinsic product

$\Delta r = 4 \times 10^{-16}$ (m) - range of nuclear vibrational motion for H_2 ortho-I molecule (in absolute coordinate system)

$p_p = 3.343482 \times 10^{15}$ (N sec/m^3) - specific partial CL pressure

5. Abbreviations used in BSM theory

BSM	Basic Structures of Matter (theory)
CL	Cosmic Lattice
CL space	Cosmic Lattice space
EQ	Electrical Quasisphere
FOHS	First Order Helical Structure
FQHE	Fractional Quantum Hall Effect
IG	Intrinsic Gravitation
MQ	Magnetic Quasisphere
NRM	Node Resonance Momentum (vector)
RL	Rectangular Lattice
RL(R)	Rectangular Lattice (Radial)
RL(T)	Rectangular Lattice (Twisted)
SPM	Spatial Precession Momentum (vector)
ZPE	Zero Point Energy