A PROPOSED THEORY OF EVERYTHING

INTRODUCTION

The proposed theory of everything [1] unites all known physical phenomena from the infinitely small (Planck cube) to the infinitely large (Super Universe). Each matter and force particle exists within the universe's fundamental building block, the Planck cube, and any universe object is representable by a volume of contiguous Planck cubes.

The theory unifies 12 fundamental matter particles, 4 bosons or fundamental force particles, 4 superpartner matter particles, 12 superpartner force particles, 16 Higgs force particles, 16 Higgsino matter particles, 64 anti-particles, and the super force or mother particle for 129 particles.

Integrated resolutions are provided to issues associated with: string theory; big bang's particle creation sequence, inflation, spontaneous symmetry breaking, Higgs force, superpartner and quark decays, neutrino oscillations, dark matter, expansions of our universe, and dark energy; messenger particles' operational mechanism, relative strengths of fundamental forces, and the hierarchy problem; Super Universe, precursor universe's super supermassive quark star/black hole, black hole entropy, arrow of time, cosmological constant problem, nested universes, and black hole information paradox; baryogenesis; and quantum gravity.

STRING THEORY [2]

The inertially stabilized X_u, Y_u, Z_u universal rectangular coordinate system of Fig. 1 originates at our universe's big bang at $x_u = 0$, $y_u = 0$, $z_u = 0$, $t = 0$ [3]. A Planck length ($l_p = 1.6 \times 10^{-35}$ meters) cube is centered at x_u, y_u, z_u at time t with the cube's X_p, Y_p, and Z_p axes aligned with the X_u, Y_u, Z_u axes. Any point within the Planck cube is identified by x_p, y_p, z_p coordinates measured from the cube's center with velocity components v_{xp}, v_{yp}, and v_{zp}. At $t = 0$, our universe consisted of a singularity centered within a Planck cube at $x_u = 0$, $y_u = 0$, and $z_u = 0$. At the present time t = 13.7 billion years, our universe consists of approximately 10^{185} contiguous Planck cubes.

Each of the 129 particles listed in Table 1 exists within a Planck cube and is equivalently represented by a dynamic phantom point particle, its unique string, or its associated Calabi-Yau membrane. In traditional string theory descriptions, a one brane vibrating string generates a two brane Calabi-Yau membrane over time. A zero brane dynamic phantom point particle generates quantized particle positions for both a one brane vibrating string and a two brane Calabi-Yau membrane over time. String theory's six extra dimensions are these position (x_p, y_p, z_p) and velocity (v_{xp}, v_{yp}, v_{zp}) coordinates. Because of the uncertainty principle, if the particle's position has zero uncertainty its momentum or velocity has infinite uncertainty. A relativistic dynamic phantom point particle (e.g. an electron-neutrino) with a 1/20 Planck time (5.4×10^{-44} seconds) sampling rate sequentially generates quantized points. Twenty points are generated as a unique vibrating string during a Planck time interval and 2000 points are generated as the associated Calabi-Yau membrane (e.g. discrete electron-neutrino cloud positions) during a 100 Planck time interval.

A basic Calabi-Yau membrane type is a beach ball to which periodic surface hills and valleys (i.e. an infinite Fourier series) are added to synthesize any particle. A string can be visualized as a thin sticky band wrapped around a Calabi-Yau membrane. For example, a circle with periodic hills and valleys is the string associated with a beach ball membrane with periodic surface hills and valleys. A membrane's potential energy can be represented by three springs aligned along the X_p, Y_p, and Z_p axes, and connected together at $x_p = 0$, $y_p = 0$, and $z_p = 0$. A Calabi-Yau membrane's energy is a function primarily of its

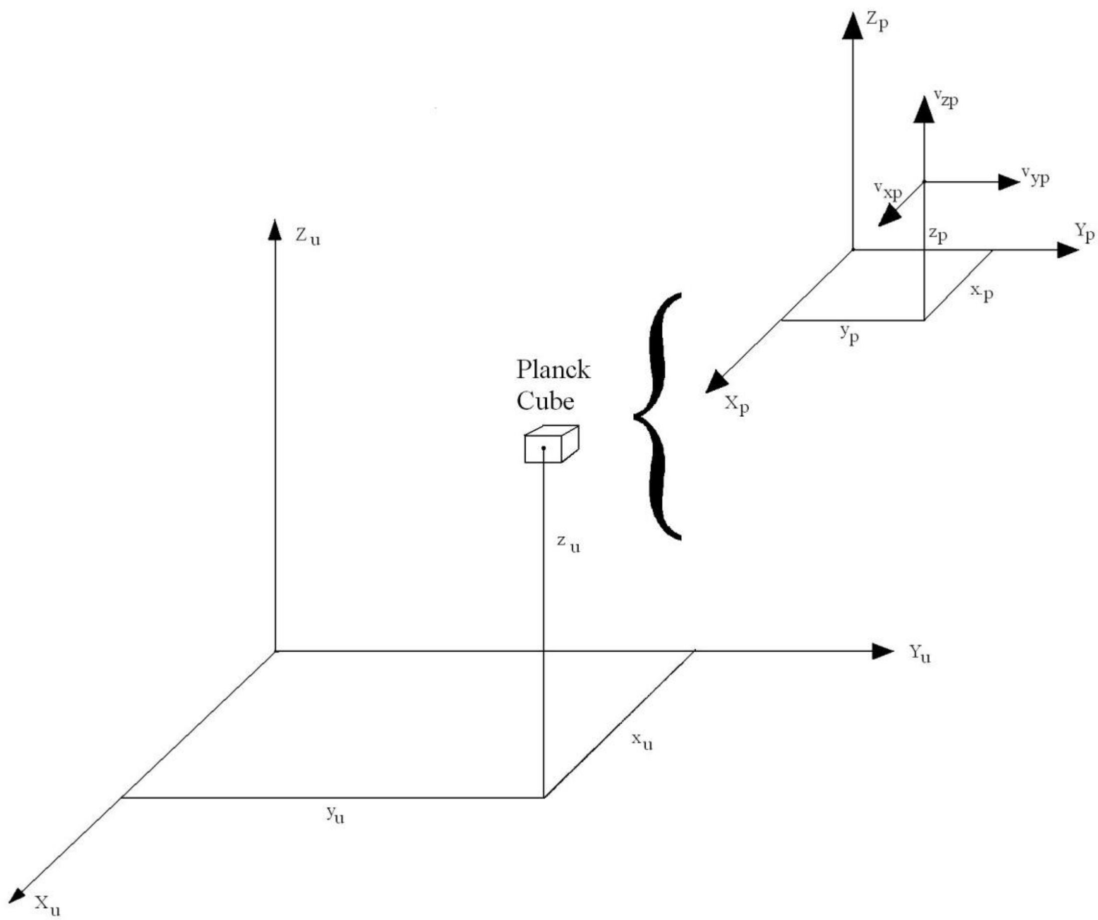

Fig. 1. Universal rectangular coordinate system.

diameter and secondarily its surface hills and valley's amplitude displacement and frequency [4]. Diameter defines the basic energy/mass level whereas the amplitude displacement and frequency fine tunes it. A Calabi-Yau membrane just touching the Planck cube sides with zero modulation represents zero tension or energy/mass. A range of modulated amplitude displacements and frequencies about this level defines the 16 fundamental matter and force particles' energy/masses, from the lightest photon (zero) to the heaviest top quark (173 GeV). In contrast, the big bang's near zero diameter singularity consists of near infinite energy/mass of approximately 10^{54} kilograms [5]. The singularity is a rotating, charged, doughnut shaped Calabi-Yau membrane (Kerr-Newman black hole).

Pauli's exclusion principle prohibits matter particles from occupying the same Planck cube (i.e. having the same quantum numbers). In contrast, Pauli's exclusion principle permits force particles (e.g. super force) to exist within the same Planck cube. A proton consisting of quarks, photons, and gluons can be represented by a volume of contiguous Planck cubes (see Fig. 5). An atom can be represented by a volume of contiguous Planck cubes consisting of protons/neutrons and orbital shell electrons. By extension, any object in the universe (e.g. molecule, encyclopedia, quark star, or the Super Universe) can be represented by a volume of contiguous Planck cubes visualized as extremely small, cubic, Lego blocks. Quantized time is represented by Planck time [6].

Table 1 Particles

Symbol	Partner	Matter	Force	Symbol	Superpartner	Matter	Force
p_1	graviton		x	p_{17}	gravitino	x	
p_2	gluon		x	p_{18}	gluino	x	
p_3	top quark	x		p_{19}	top squark		x
p_4	bottom quark	x		p_{20}	bottom squark		x
p_5	tau	x		p_{21}	stau		x
p_6	charm quark	x		p_{22}	charm squark		x
p_7	strange quark	x		p_{23}	strange squark		x
p_8	muon	x		p_{24}	smuon		x
p_9	tau-neutrino	x		p_{25}	tau-sneutrino		x
p_{10}	down quark	x		p_{26}	down squark		x
p_{11}	up quark	x		p_{27}	up squark		x
p_{12}	electron	x		p_{28}	selectron		x
p_{13}	muon-neutrino	x		p_{29}	muon-sneutrino		x
p_{14}	electron-neutrino	x		p_{30}	electron-sneutrino		x
p_{15}	W/Z bosons		x	p_{31}	wino/zinos	x	
p_{16}	photon		x	p_{32}	photino	x	

12	fundamental matter	$p_3 \ldots p_{14}$
4	fundamental force	p_1, p_2, p_{15} [7], p_{16}
4	superpartner matter	p_{17}, p_{18}, p_{31}, p_{32}
12	superpartner force	$p_{19} \ldots p_{30}$
16	Higgs force	$h_{3 \ldots} h_{14}$, h_{17}, h_{18}, h_{31}, h_{32}
16	Higgsino matter	h_1, h_2, h_{15}, h_{16}, $h_{19 \ldots} h_{30}$
64	anti-particles	$p_{1bar} \ldots p_{32bar}$, $h_{1bar} \ldots h_{32bar}$
1	super force (mother)	p_{sf}

129	total	

BIG BANG

Particle creation sequence/Inflation

Fig. 2 shows the big bang's creation of our universe's 128 particles from the super force [8]. Total particle energy is represented by upper case letters, for example, total up quark energy is P_{11}. Up quark energy density (P_{11d}) is total up quark energy (P_{11}) divided by the number of our universe's Planck cubes at time t. Table 1's lower case letters represent an individual particle's energy/mass, for example, the up quark (p_{11}) equals 2 MeV. A particle's energy/mass (p_{11}) multiplied by the number of up quark particles (n_{11}) also yields the total particle energy (P_{11}).

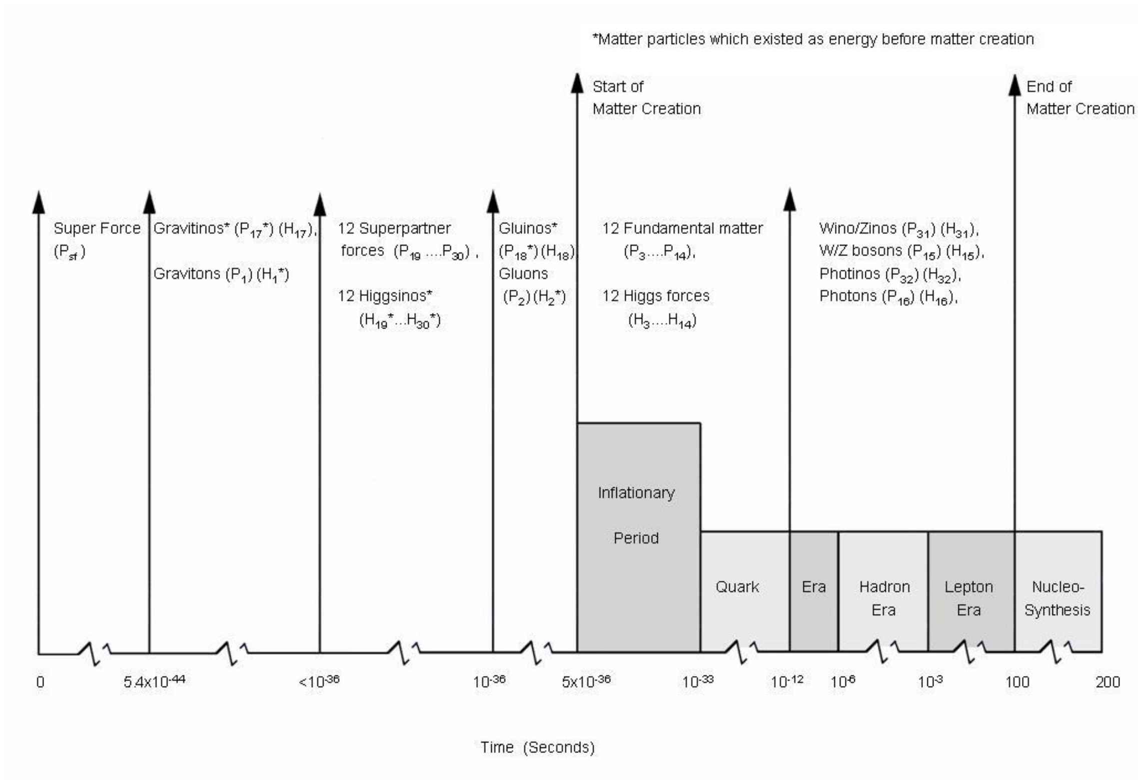

Fig 2: Big Bang.

Fig. 2 shows creation of energies for gravitinos* (P_{17}*)/gravitons (P_1) at t = 5.4 x 10^{-44} seconds and gluinos* (P_{18}*) /gluons (P_2) at t = 10^{-36} seconds. The asterisk (*) signifies matter particles which existed as energy before matter creation. Twelve superpartner force energies (P_{19}….P_{30}) were created at < 10^{-36} seconds and consisted of Grand Unified Theory (GUT) and X bosons. GUT bosons included 8 gluons (p_2), 3 W/Z bosons (p_{15}), and photons (p_{16}) [9]. Combinations of gluons, W/Z bosons, and photons were known as X bosons [10].

Matter creation coincided with both the inflationary period start time (5 x 10^{-36} seconds) and the one to seven Planck cubes energy to matter expansion. There was no reheating phase following inflation. Since Pauli's exclusion principle prohibited matter particles from existing within the same Planck cube, matter did not exist when our universe was smaller than one Planck cube (universe radius of .8 x10^{-35} meters), see Fig. 3 [11]. The one to seven Planck cube expansion consisted of six contiguous Planck cubes attached to the six faces of our universe's original Planck cube. The original Planck cube contained superimposed force particles whereas the six contiguous cubes contained six matter particles. Following the start of matter creation, gravitinos* (P_{17}*), gluinos* (P_{18}*), and 12 fundamental matter particle energies (P_3….P_{14}) were converted to matter particles. At t = 10^{-12} seconds, W/Z bosons (P_{15}), winos/zinos (P_{31}) and photino (P_{32}) energies were converted to matter particles.

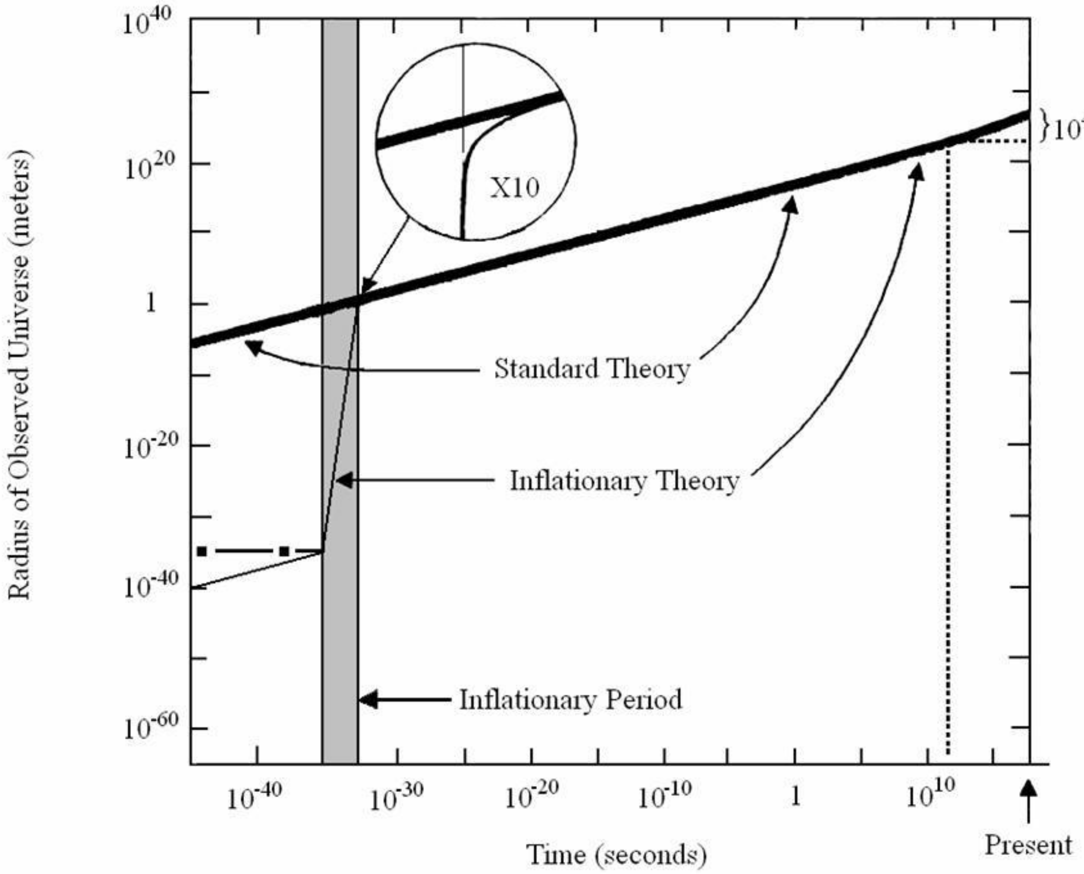

Fig. 3. Size of the universe in the standard and inflationary theories.

Particle/anti-particle pairs initially condensed from super force energy and evaporated back. As our universe expanded and cooled this baryogenesis process was predominantly from energy to matter rather than to anti-matter (see Baryogenesis section). Particles/anti-particles were the intermediate or false vacuum state prior to the permanent matter plus true vacuum state. During matter creation (5×10^{-36} to 100 seconds), our universe consisted of a time varying particle soup. The end of matter creation was defined as 100 seconds because by: 10^{-3} seconds, up and down quarks formed protons and neutrons; 1 second, neutrinos decoupled from matter; 100 seconds, only electrons remained following electron anti-electron annihilations and nucleosynthesis began.

Spontaneous symmetry breaking/Higgs force

The process of generating 16 matter particles, W/Z bosons, and their 17 associated Higgs force particles is spontaneous symmetry breaking or the Higgs mechanism [12]. Matter particles and their associated Higgs forces are one and inseparable. Spontaneous symmetry breaking is bidirectional, supporting condensations and evaporations. Similar to the three phases cooling condensation from steam to water to ice, super force energy condenses into matter particles and their associated Higgs forces at specific temperatures. Higgs force particles are residual super force particles containing characteristics (e.g. mass, charge, spin) of their associated matter particles.

Fig. 2 shows 32 matter and force energies designated as P_1....P_{32}. These included gravitons (P_1), gluons (P_2), twelve fundamental matter particles (P_3….P_{14}), W/Z bosons (P_{15}), photons (P_{16}), 4 superpartner matter particles (P_{17}*, P_{18}*, P_{31}, and P_{32}), and 12 superpartner force particles (P_{19}….P_{30}) energies. The 17 Higgs force energies (H_3.…H_{14}, H_{15}, H_{17}, H_{18}, H_{31}, H_{32}) were super force energy residuals from condensations of 12 fundamental matter, four superpartner matter, and W/Z bosons energies. There were also 15 (14 Higgsinos* and 1 Higgsinos) matter particle energies (H_1*, H_2*, H_{19}*….H_{30}*, H_{16}) for a total of 32 Higgs particles. Associated with these 64 matter and force particles were 64 anti-particle energies (e.g. P_{11bar} is anti-up quark energy). Anti-particles condensed at the same temperature and time as their identical energy/mass particles but were not explicitly shown in Fig. 2. Thus, super force (P_{sf}) energy equaled 32 matter and force particles, 32 associated Higgs particles, and 64 anti-particles energies or, P_{sf} = (P_1 + H_1*)….(P_{32} + H_{32}) and (P_{1bar} + H_{1bar})….(P_{32bar} + H_{32bar}) energies [13]. From Fig. 2 at $t = 5.4 \times 10^{-44}$ seconds, one super force pair's energy (P_1 + H_1*) converted into gravitons' energy (P_1) and its associated Higgsino* energy (H_1*) and a second super force pair (P_{17}* + H_{17}) converted into the gravitinos* energy (P_{17}*) and its associated Higgs force energy (H_{17}). At $t = 10^{-36}$ seconds, a third super force pair's energy (P_2 + H_2*) converted into gluons' energy (P_2) and its associated Higgsino* energy (H_2*) and a fourth super force pair (P_{18}* + H_{18}) converted into gluinos* energy (P_{18}*) and its associated Higgs force energy (H_{18}). Prior to $t = 10^{-36}$ seconds, 12 superpartner force energy pairs [(P_{19} + H_{19}*) ….(P_{30} + H_{30}*)] converted into the GUT and X bosons' energies and their associated Higgsinos* energies. During our universe's matter creation period (5×10^{-36} to 100 seconds) [14], four superpartner matter energies (P_{17}*, P_{18}*, P_{31}, P_{32}), their associated Higgs force energies (H_{17}, H_{18}, H_{31}, H_{32}), 12 fundamental matter energies (P_3....P_{14}) and their associated Higgs force energies (H_3….H_{14}) created four superpartner matter, 12 fundamental matter, and 16 associated Higgs force particles. At $t=10^{-12}$ seconds, two super force pairs of energy (P_{15} + H_{15}) and (P_{16} + H_{16}) converted into W/Z bosons (P_{15}), photons (P_{16}), and their two associated Higgs particles' (H_{15}, H_{16}) energies.

The generic spontaneous symmetry breaking function is shown in Fig. 4 [15]. The Z axis represents energy density. The X axis represents one Higgs force particle's energy (e.g. h_{11}) associated with a particle (e.g. up quark p_{11}). Similarly the Y axis represents one Higgs force particle's energy (h_{11}bar) associated with the anti-up quark particle (p_{11bar}). Because of the early universe's baryon or quark asymmetry, anti-particles quickly disappear and Fig. 4 compresses to the two dimensional Z versus X diagram shown in the Fig. 4 inset. The Z axis represents: prior to condensation, the particle (e.g. up quark) and its associated Higgs force energy densities [e.g. (P_{11d} + H_{11d})]; or following condensation, the associated Higgs force energy density (H_{11d}). At $h_{11} = h_{11bar} = 0$, the sum of the two energy densities is maximum. At a position shown by the ball ($h_{11} = -2$, h_{11}bar = 0, Z = 1.5), condensation of up quark (p_{11}) particles is complete, and its associated h_{11} is non-zero [16]. Following condensation, the h_{11} non-zero value (-2) remains constant, (i.e. ball slowly over 13.7 billion years moves vertically down and approaches the vacuum circle) while the associated Higgs energy density (H_{11d}) decreases as our universe expands. Each Higgs force particle, (e.g. h_{11}), contains the characteristics (e.g. mass, charges, and spin) of its associated particle (e.g. p_{11}) and itself (see Fig. 5 Inset). The Higgs force particle (e.g. h_{11}) is visualized as a three dimensional field surrounding and attached to the p_{11} particle or symbolically as a single Planck cube attached to its p_{11} particle [17].

Super force condensations occurred for 16 matter particles (p_3….p_{14}, p_{17}, p_{18}, p_{31}, p_{32}) and W/Z bosons (p_{15}) and produced 17 associated Higgs force particles (h_3….h_{14}, h_{15}, h_{17}, h_{18}, h_{31}, h_{32}). The heaviest matter particle's (e.g. gravitino p_{17}) spontaneous symmetry breaking function coincided with the inflationary period start time. There were 17 unique spontaneous symmetry breaking functions which occurred at different energy/temperatures or times [18].

The true vacuum state was space without matter or the lowest energy/temperature density state. The sum of eight permanent Higgs force particles' energies (H_9, H_{10}, H_{11}, H_{12}, H_{13}, H_{14}, H_{31}, H_{32}) [19] corresponding to eight permanent particles (tau-neutrino p_9, down quark p_{10}, up quark p_{11}, electron p_{12},

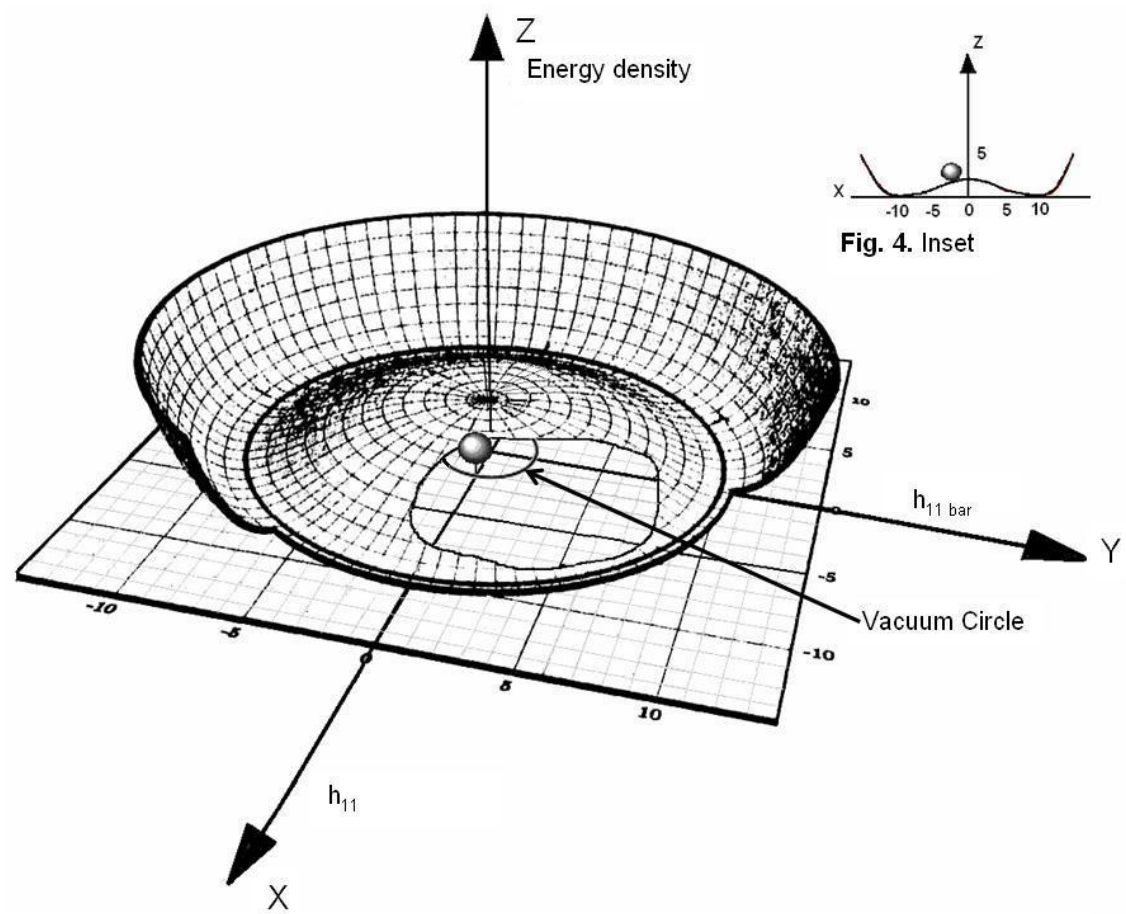

Fig. 4. Generic spontaneous symmetry breaking function

muon-neutrino p_{13}, electron-neutrino p_{14}, wino/zinos p_{31}, and photino p_{32}) constituted dark or vacuum energy [20]. In contrast, the false vacuum state was the super force energy equivalent of transient matter particles and their associated Higgs forces (e.g. top quarks, W/Z bosons, and particles/anti-particles).

Each of the 129 particles was assumed to exist within a Planck cube although each may exist in a larger augmented Planck cube (l_{ap}). Scattering experiments reveal quarks and leptons to be smaller than 10^{-18} meters [21]. If higher resolution scattering reveals quarks and leptons are larger than a Planck cube, all analyses remains valid by replacing a Planck cube with an augmented Planck cube [22].

Superpartner and quark decays/Neutrino oscillations

Matter particles were created directly from super force energy or indirectly via a heavier particle's decay. Decays were mediated by gauge not gravitational interactions. During indirect creation, heavier particles decayed in a cascading process to lower energy/mass matter particles and intermediate force particles. Intermediate force particles were W/Z bosons for Standard Model (SM) particles and X bosons for supersymmetric particles. For example, there were two primary W^- decay branches, energy (quark/anti-quark) and matter (lepton and anti-neutrino) [23]. Similarly, there were two X boson decay branches, energy (superpartner matter/superpartner anti-matter) and matter (quark and lepton).

Superpartners decayed into lower mass superpartners. The decay chain ended with the stable Lightest Supersymmetric Particle (LSP) and SM particles [24]. Heavy quarks decayed into lower mass quarks and W bosons defined by the Cabibbo-Kobayashi-Maskawa (CKM) matrix (e.g. a Beta minus decay of a down quark into an up quark and a W^- boson) [25].

Quark and superpartner decays were described by modified weak force Feynman diagrams. Two modifications were: inclusion of associated Higgs forces with matter particles and division of energy not matter particles. Beta minus decay was as follows. The down quark (p_{10}) and its associated Higgs force (h_{10}) evaporated to a super force particle (p_{sf}) having energy/mass ($p_{10} + h_{10}$). One energy/mass portion condensed into the up quark (p_{11}) and its associated Higgs force (h_{11}), whereas a second condensed into the W^- particle (p_{15}) and its associated Higgs force (h_{15}). Within 10^{-25} seconds, the transient W^- and its associated Higgs force evaporated back to a super force energy particle having energy/mass ($p_{15} + h_{15}$). This energy/mass then condensed into an electron (p_{12}), its associated Higgs force (h_{12}), an anti-electron neutrino (p_{14bar}), and its associated Higgs force (h_{14bar}). Simultaneous evaporation of a matter particle and its associated Higgs force and subsequent simultaneous condensation to a lighter matter particle and its associated Higgs force, defined matter (e.g. Beta) and Higgs decays.

There were three neutrino flavors: electron-neutrino, muon-neutrino, and tau-neutrino. Neutrinos oscillated between three flavors via the seesaw model using an undiscovered neutral heavy lepton (NHL). According to this seesaw model, neutrino mass was $(m_D)^2/M_{NHL}$, where m_D was the SM Dirac mass (i.e. p_{14}, p_{13}, p_9) and M_{NHL} was the neutral heavy lepton mass [26]. The neutral heavy lepton appeared in some SM extensions and was assumed to be the stable fourth family neutrino and a constituent of dark matter [27].

Dark matter

Superpartners decay into the LSP and SM quarks, leptons, and photons. A prime candidate for dark matter is the LSP or neutralino which is an amalgam of the photino (p_{32}), zino (p_{31}), and possibly other particles including Higgsinos [28]. Dark matter is assumed to consist of a subset of two superpartner matter particles (p_{31}, p_{32}), Higgsinos matter particles (h_1*, h_2*, h_{19}*….h_{30}*, h_{16}), and neutral heavy leptons (either p_{31} or p_{32}).

Start of dark matter agglomeration defined the transition between our universe's uniform and non-uniform distribution of matter expansions. Following this transition, galactic regions were represented by static spatial cubes whereas intergalactic regions were represented by dynamic spatial cubes. Assuming a dark matter agglomeration start time of 30,000 years [29], the Fig. 3 dotted lines show a 10^4 universe range factor expansion from 30,000 years (~ 10^{12} seconds) to the present.

Dark matter agglomeration formed the framework of galaxies. Between 30,000 and 380,000 years dark matter clumped together, whereas electrically charged matter particles did not. At 380,000 years, electrically neutral atoms formed and began clumping around the dark matter framework [30].

Expansions of our universe

There were four sequential universe expansion phases; within our universe's first Planck cube, inflationary period, uniform distribution of matter, and non-uniform distribution of matter.

During the first phase, our universe's size expanded from a singularity's radius of less than 10^{-40} meters at $t = 0$, to a radius of $.8 \times 10^{-35}$ meters at the start of matter creation (Figs. 2 and 3). Entropy increase of the super, gravitinos*, gravitons, 12 superpartner forces, gluinos*, gluons, and 16 associated Higgs particles drove this expansion similar to the unraveling of a knot.

The inflationary period expansion was similar a water container freezing and bursting. More energy exists in liquid than frozen water. When water freezes, its temperature remains constant and latent heat is released. X bosons (inflatons) were the latent heat energy source during inflation [31]. During the one to seven Planck cube expansion, six matter particles were created (i.e. condensed or frozen) and expelled from the original Planck cube to the surrounding Planck cube shell. Then, the first matter shell was pushed out to create the second matter Planck cube shell. This process continued until enough Planck cubes existed for all matter particles.

Universe expansion occurred from 10^{-33} seconds to 30,000 years for the uniform distribution of matter and from 30,000 years to the present for the non-uniform distribution of matter. Similar to the expansion of carbon dioxide gas in a room after a bottle of Coke is opened, dark energy (i.e. Higgs force particles) drove both the uniform and non-uniform distribution of matter expansions [32].

Our universe's non-uniform distribution of matter expansion is represented by a pennies/dough/balloon model consisting of pennies mixed in rising dough (electromagnetically transparent) in a balloon. Space between galaxies expands whereas space within galaxies does not. The rigid pennies (galaxies) do not expand, whereas the dough (intergalactic space) and the balloon (universe) expand.

Einstein's general relativity representation via static spatial squares (cubes) on a galactic rubber fabric must transition into dynamic spatial squares of intergalactic regions [33]. Newton's gravitational force equation ($F=Gm_1m_2/r^2$) is valid for galactic regions. For intergalactic regions the radius (r) must be amplified. The radius (r) consists of two components $r_1 + e_rt_i$. The first constant component (r_1) is the initial radius between two masses in two galaxies at a graviton's emission time. The second variable component (e_rt_i) is our universe's non-uniform distribution of matter expansion rate (e_r) [34] multiplied by the graviton's intergalactic propagation time (t_i). This product is string theory's seventh extra dimension which dilutes the intergalactic gravitational force because of our universe's non-uniform distribution of matter expansion.

Dark energy

At the end of nucleosynthesis (t = 200 seconds), our universe consisted of uniformly distributed matter particles (e.g. electrons, protons, helium nuclei, neutrinos, and dark matter) and Higgs force particles in the space between matter particles (true vacuum). Our universe's uniform 10^8 K temperature caused electrons, protons, and helium nuclei radiation emission/absorption. At 380,000 years, radiation ended and neutral atoms clumped around the dark matter framework. Galaxies formed after 200 million years and the temperature of intergalactic space decreased relative to galaxies. Currently, that vacuum temperature is 2.73 K.

At 200 seconds, our universe consisted of baryonic matter (4.6 %), cold dark matter (22.8%), dark energy (72.6%), and neutrinos (<1%), and these percentages remained constant for 13.7 billion years [35]. The cosmological constant lambda (Λ) was proportional to the vacuum or dark energy density (ρ_Λ), or $\Lambda = (8\pi G/3c^2)\,\rho_\Lambda$, where G is the gravitational constant and c is the speed of light [36]. Dark energy density: was uniformly distributed in our universe; was the sum of eight permanent Higgs force particles' densities, or $\rho_{\Lambda =}$ H_{9d}, H_{10d}, H_{11d}, H_{12d}, H_{13d}, H_{14d}, H_{31d}, H_{32d}; and decreased with time with the cosmological constant as our universe expanded.

MESSENGER PARTICLES

Operational mechanism

A messenger particle's embedded clock/computer is its operational mechanism. Particles are insufficient to constitute matter, glues are also required. Strong force glue (gluon) is required for nuclei.

Electromagnetic force glue (photon) is required for atoms/molecules. Gravitational force glue (graviton) is required for multi-mass systems [37].

Gravitational/electromagnetic

Newton's gravitational force ($F = Gm_1m_2/r^2$) and Coulomb's force ($F = Cq_1q_2/r^2$) equations have the same form, where m_1 and m_2 are two masses, q_1 and q_2 are two charges, r is the range between masses/charges, G is the gravitational constant, and C is Coulomb's constant. The graviton encodes mass (m_1) and the photon encodes charge (q_1) from the Higgs force particle (e.g. h_{11} of Fig. 5 Inset) associated with the transmitting particle (e.g. p_{11}). G and C are embedded in the graviton (p_1) and photon (p_{16}) templates of the transmitting particle. The clock initiates at transmission time t_t and stops at reception time t_r. The computer calculates the range factor ($1/r^2$) as $1/[(t_r – t_t)(c)]^2$. Upon graviton/photon reception the receiving mass m_2 or charge q_2 are available from the Higgs force particle associated with the receiving particle. The graviton/photon computer calculates the gravitational or Coulomb force and provides it to the receiving particle.

Strong

The Fig. 5 hydrogen nucleus (proton) consists of contiguous Planck cubes in three nested spheres where the third sphere's radius is 1.0×10^{-15} meters. Fig. 5 is shown in two instead of three dimensions and not to scale. Up quarks (p_{11}), down quarks (p_{10}), photons (p_{16}), and gluons (p_2) exist within their own Planck squares. Gravitons are not included because the gravitational force is negligible within the proton radius. Attached to each matter particle is its associated symbolic Higgs force particle. The latter includes mass, charges, and spin of both the particle (p_{11}) and its associated Higgs (h_{11}), and messenger particle p_1, p_2, p_{15}, p_{16} templates [38].

The proton's inner sphere contains two up and one down valence quarks. Quarks have color charges transmitted via gluons. There are three color charges (blue, green, and red) and three anti-color charges (anti-blue, anti-green, and anti-red). Together, the three valance quarks are colorless. The second spherical volume contains a cloud of virtual or transient quark/anti-quark pairs. A virtual gluon cloud exists in the third spherical volume and the two clouds adopt color charges of the valence quarks.

Quantum Chromodynamics (QCD) is the strong force theory and has two major properties, confinement where the force between quarks does not diminish with separation and asymptotic freedom where the force approaches zero in high energy environments. Potential energy between two quarks is $V = - \alpha_s/r + kr$ and force is $F = -dV/dr = \alpha_s/r^2 - k$ where r is quark separation, k is a constant, and α_s is the running (nonlinear) coupling constant which decreases with separation. The force equation has two components, a Coulomb like force (α_s/r^2) and a constant force (-k). As two confined quarks separate, the gluon fields form narrow tubes of color charge, which attract the quarks as if confined by an elastic bag. When the stored energy is greater than the mass of two quarks, new quark anti-quark pairs are created. For quark separations comparable to the proton's radius, the gluon computer provides the constant –k force to the receiving quark. For quark separations less than a proton radius, the gluon computer calculates the strong force using either the Coulomb term or a force versus range table and provides it to the receiving quark [39].

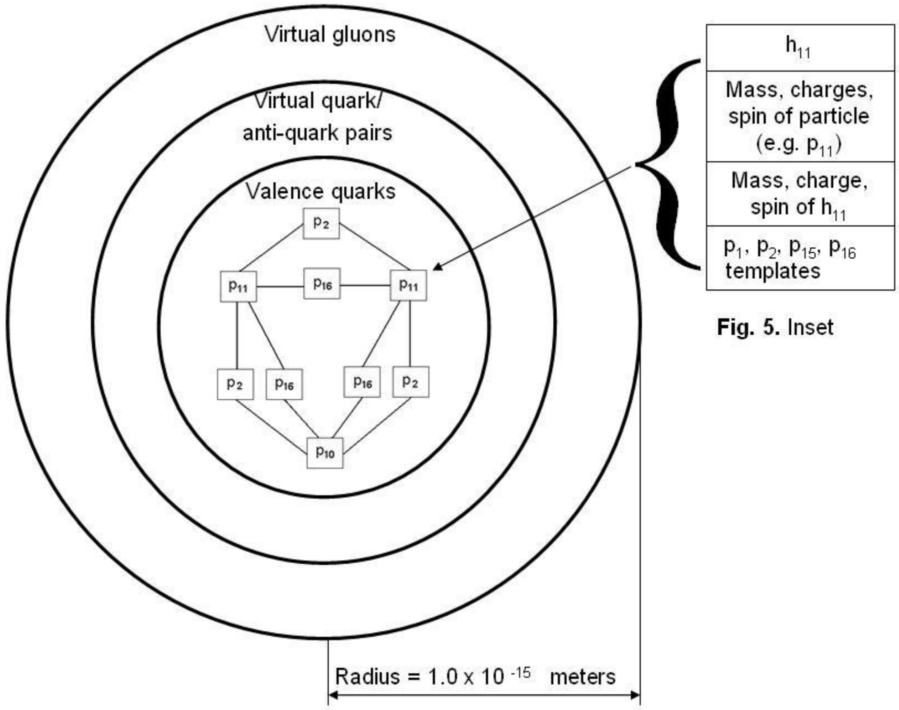

Fig. 5. Inset

Fig. 5. Hydrogen nucleus (proton).

Relative strengths of fundamental forces/Hierarchy problem

The relative strengths of the gravitational and electromagnetic/weak forces are due to propagation factor dilution $(1/r^2)$ or $1/(ct)^2$ between gravitational force activation and electromagnetic/weak force creation/activation. Column two of Table 3 shows relative strengths of forces.

Table 3 Relative Strengths of Forces

Force	Physics Handbook [40]	Figure 2 Derived
Strong	1	1
Electromagnetic/weak	10^{-3} to 10^{-2}	10^{-2}
Gravitational	10^{-42}	10^{-44}

At unification, all force strengths were equal. From Fig. 2, the graviton was created at 5.4 x 10^{-44} seconds but activated at the first permanent matter particle creation time or after 5 x 10^{-36} seconds (assumed to be 10^{-33} seconds). At electromagnetic/weak force creation/activation time (10^{-12} seconds), the gravitational force had already been diluted by $(t_1/t_2)^2 = (10^{-33}/10^{-12})^2$ or 10^{-42} (hierarchy factor). The 10^{-21} time or

10^{-42} strength bias was embedded in the graviton (p_1) and photon (p_{16}) templates. The Fig. 2 derived values in column 3 were comparable to column 2 values, considering the uncertainties of the column 2 reference and Fig. 2.

SUPER UNIVERSE/PRECURSOR UNIVERSE'S SUPER SUPERMASSIVE QUARK STAR BLACK HOLE

Universal laws of physics and structure were assumed across the Super Universe which consisted of nested universes. For example, the Super Universe obeyed conservation of energy, contained 129 particles, and had a constant dark energy to matter ratio (72.6/27.4) identical to our universe.

Black hole types

A black hole is currently defined as a region of space-time where gravity is so strong not even light can escape and having no support level below neutron degeneracy. The space-time region is a three dimensional sphere which appears as a two dimensional hole. Three black hole types are: stellar, supermassive, and super supermassive [41].

Stellar gravitational collapse occurs when energy from nuclear reactions is insufficient to resist the star's own gravity and is stopped by Pauli's exclusion principle degeneracy pressure. If the star's mass is less than 8 solar masses, it stops contracting and becomes a white dwarf supported by electron degeneracy pressure. If the star is between 8 and 20 solar masses, it explodes as a supernova and becomes a neutron star supported by neutron degeneracy pressure. Above 20 solar masses, the star explodes as a supernova and becomes a stellar black hole [42].

Supermassive black holes contain 10^6 to 10^9 solar masses, may be "fossil quasars" [43], and their masses are proportional to their host galaxies' masses [44]. Population III stars containing hydrogen, helium, and lithium first formed 200 million years after the big bang. These "first generation" stars contained 100 times more gas than the sun, had short lives, exploded as supernovas, created over 100 billion supermassive black holes, and reionized our universe [45]. By accretion of stars/matter and merger with galaxies, these supermassive black holes formed our universe's approximately 100 billion galaxies.

Super supermassive quark star/black holes (approximately 10^{23} solar masses) were to universes as supermassive black holes were to galaxies. Our precursor universe's super supermassive quark star/black hole consisted of a quark star matter state (cold quark matter) [46] followed by a black hole energy state. Both matter and energy states were "black" because light could not escape. The quark star (matter) formed following a quark-nova's confinement energy release, or a delayed secondary explosion following a neutron star's primary supernova explosion [47]. The quark star increased in size via accretion of stars/matter and merger with galaxies. After quark degeneracy pressure was insufficient to stop further collapse, the quark star (matter) instantaneously deflated and transformed into the black hole (energy).

A black hole was thus redefined as a quark star (matter)/black hole (energy) both of which were "black." The probability was near zero that our universe's near infinite energy was created from nothing. Our precursor universe's super supermassive quark star/black hole created our universe's "big bang" (white hole) by transferring its total energy/mass via conservation of energy.

Black hole entropy

Entropy of a black hole is currently defined as $S_{BH} = \eta A/(l_p)^2$ where η is a constant, A is the event horizon area, and l_p is the Planck length [48]. BH stands for either "black hole" or "Bekenstein-Hawking."

A second proposed entropy formula uses Boltzmann's equation $S = k \log \Omega$, where k is Boltzmann's constant, and Ω is the total number of different ways matter particles can arrange themselves. For the quark star (matter), the total number of ways of distributing N matter particles each in a Planck cube volume $(l_p)^3$ within a quark star of volume $V = (4\pi r^3/3)$ is [49]:

$S = k \log \Omega$ where

$\Omega = (1/N!)(V/(l_p)^3)^N$ or

$\Omega = (1/N!)(4\pi r^3/3(l_p)^3)^N$

Arrow of time

In an isolated system such as our universe, the Second Law of Thermodynamics states entropy increases irreversibly with time and provides a thermodynamic arrow of time. In contrast, Einstein's general relativity is time symmetric and apparently contradicts the Second Law of Thermodynamics. Schwarzschild's solution of Einstein's equations consists of a black hole, a white hole, and an Einstein-Rosen bridge or wormhole connecting the two universes [50].

During a specific time interval within a subset volume of our universe, entropy decreased without negating our universe's Second Law of Thermodynamics [51]. A nebula's hydrogen and helium gas, dust, and plasma began ordering itself at our solar system's creation 4.6 billion years ago. Entropy decreased and life was created. Since our solar system was one of approximately 100 billion Milky Way galaxy stars and our galaxy was one of approximately 100 billion universe galaxies, our solar system's entropy decrease was less than our universe's entropy increase. Life may exist on concurrent solar systems if the sum of their entropy decreases was less than our universe's entropy increase. Similarly, entropy increased with God or super-observer time in our precursor universe whereas entropy decreased in a precursor universe's subset volume.

Fig. 6 shows our precursor universe's super supermassive quark star/black hole transition to our universe's big bang (white hole). For analysis simplicity, our universe was assumed to consist of the up quark, down quark, electron, and super force particles instead of all 129 particles [52]. Fig. 6 shows a time symmetry estimated to be -10^{-33} to 10^{-33} seconds [53]. The number of super force particles was; a maximum at $t = 0$, decreased as matter particles condensed from it, and reached zero by the end of matter creation at 100 seconds. Down and up quarks appeared after the start of matter creation and reached their steady state values by the end of the hadron era at $t = 10^{-3}$ seconds or 170 MeV [54]. Electrons appeared after the start of matter creation and reached their steady state value by the end of the lepton era at 100 seconds [55].

The Hawking temperature of the quark star (matter) with mass M was $T=10^{-7}$ $(M_\odot /M)$ K and its life time t was approximately 10^{66} $(M/M_\odot)^3$ years, where $M_\odot$ was solar mass, and K was degrees Kelvin [56]. The larger the mass, the lower was its temperature and longer its life time. As the quark star (matter) accumulated matter, its mass and life time approached near infinite whereas its temperature approached zero. During the quark star/black hole matter to energy transformation, mass, life time, and temperature values flipped. The mass and life time approached zero, temperature approached near infinite, but total energy/mass was conserved. In the quark star (matter), energy/mass was spread over a near infinite number of Planck cubes. During the matter to energy transformation (deflationary period), each matter particle and its associated Higgs force evaporated to super force energy leaving a true vacuum with no particles in its wake. In the black hole (energy), energy/mass was concentrated in a Planck cube singularity. Since the black hole's (energy) near infinite temperature was much larger than the surrounding vacuum, it transitioned to the white hole and initiated our universe's thermodynamic arrow of time. This process complied with Einstein's time symmetric general relativity.

In the quark star (matter), entropy increased with time. However, during the matter to energy transformation, the maximum entropy quark star (matter) transformed to the minimum entropy black hole

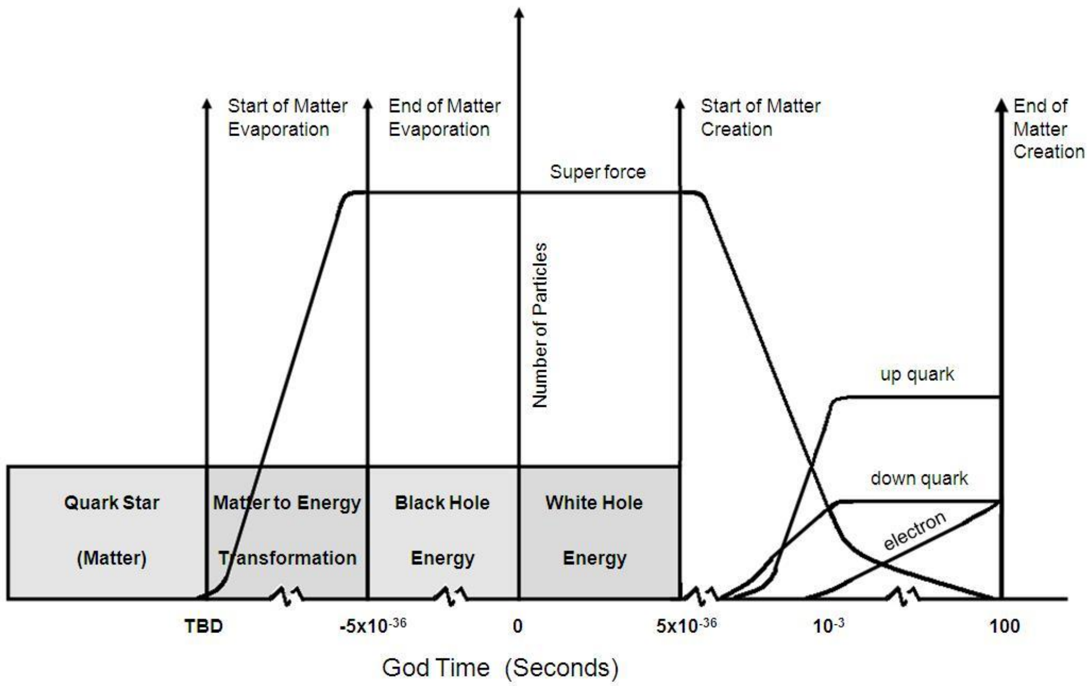

Fig. 6. Quark star/Black hole to Big bang (white hole) transition.

(energy). In essence, the super supermassive quark star/black hole "resurrected" life via creation of the "mother" super force particles in a subset volume of our precursor's universe. Thus, the super supermassive quark star/black hole had a dual nature; destruction of structure (information) in the quark star (matter) and resurrection of life in the black hole (energy).

Cosmological constant problem/Nested universes

The observed cosmological constant was 10^{-120} of the expected value (2×10^{110} erg/cm^3) and known as the cosmological constant problem [57]. According to Steinhardt, this problem existed because the universe was older than expected due to precursor cyclical universes [58]. Cyclical universes were special cases of nested universes where the quark star/black hole subset volume equaled the total precursor universe volume.

Fig. 7 shows three nested universes consisting of precursor universe 2, precursor universe 1, and our universe at three sequential God times (in two instead of three dimensions and not to scale). At t = TBD (to be determined), a super super supermassive black hole exists in precursor universe 2. By t = 0, that super super supermassive black hole expands into precursor universe 1. Within precursor universe 1, a super supermassive black hole forms. The super supermassive quark star/black hole transitions to the big

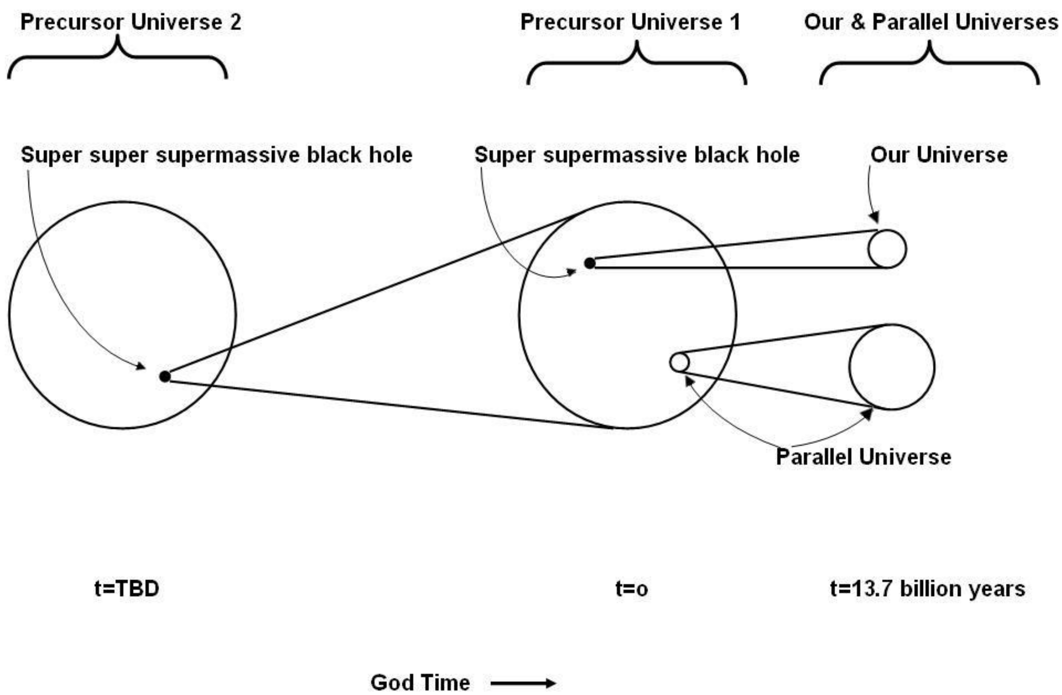

Fig. 7. Nested Universes

bang's white hole and after 13.7 billion years of expansion, our present universe exists. Fig. 7 also shows precursor universe 1 spawning a "parallel" universe. A super supermassive quark star/black hole or larger is required to create new nested universes.

Fig. 8 shows the three nested universes at t = 0. Our universe and a "parallel" universe are nested within precursor universe 1. Precursor universe 1 is nested within precursor universe 2. Precursor universe 2 is a Super Universe sub-volume. Dark energy density is a constant and uniformly distributed throughout all universes, including the Super Universe, all precursor universes, and our universe. As the Super Universe expands via eternal inflation, dark energy density decreases with time. Since matter is not uniformly distributed in precursor universe 1, subset volumes form super supermassive black holes (energy) which transition to white holes (e.g. our universe and parallel universe) and redistribute matter.

The cosmological constant problem was caused because the Super Universe's volume was 10^{120} larger than our universe's volume. Since spherical volumes were proportional to their radii cubed, the ratio of the Super Universe's radius R_{su} to our universe's radius R_{ou} was $(10^{120})^{1/3}$ or 10^{40}. The Super Universe's radius was $R_{su} = (10^{40})(46.5 \times 10^{9}$ light years) or approximately 10^{50} light years. Assuming equal expansion rates, that is, our universe's radius/our universe's age = Super Universe's radius/Super Universe's age, the Super Universe's age was approximately 10^{50} years.

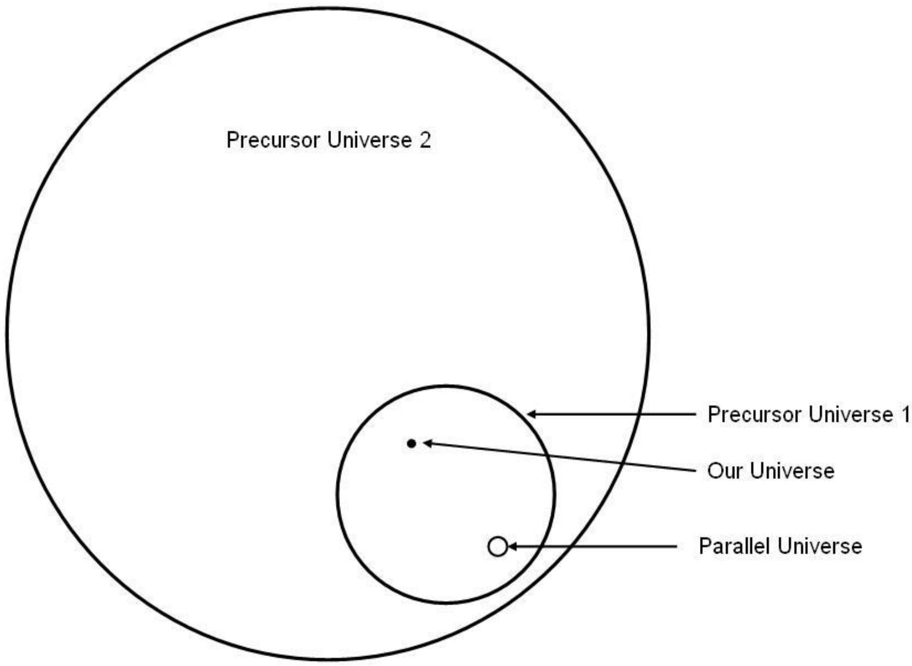

Fig. 8. Three Nested Universes at t=0.

Black hole information paradox

In 1975, Hawking stated Hawking radiation contained no information swallowed by a black hole. In 2004, his position reversed and Hawking radiation contained information. This is the black hole information paradox.

The "No Hair" theorem states a black hole has three independent parameters (information); mass, charge and spin [59], whereas our universe contains near infinite information. Any universe object's (e.g. an encyclopedia) intrinsic information at time = t consists of the contents and positions (x_u, y_u, z_u, t of Fig. 1) of all the object's contiguous Planck cubes. Specifically, information consists of the unique relative orientation of up quarks, down quarks, and electrons to each other. Each up quark, down quark, and electron resides within a specific Planck cube of the encyclopedia's ink, paper, binding, etc. molecules. Encyclopedia information is lost in star stages during decomposition of its molecules to atoms, to protons/neutrons and electrons, to quarks, and to super force energy. In a white dwarf star, molecules decompose to atoms. In a neutron star, atoms decompose to protons, neutrons, and electrons. In a quark star (matter), protons/neutrons decompose to quarks. In a black hole (energy), matter decomposes to super force particles. Thus, information is lost in quark star/black hole formation and none is emitted as Hawking radiation.

BARYOGENESIS

Baryogenesis is the asymmetric production of baryons and anti-baryons in the early universe expressed as the baryon to photon ratio $\eta = 6.1 \times 10^{-10}$ [60]. There are 42 identified baryogenesis theories of which six are prominent; electroweak, GUT, quantum gravity, leptogenesis, Affleck-Dine, and CPT (charge, parity, time) [61]. Electroweak occurs insufficiently in the SM and is considered unlikely without supersymmetry. Inflationary scenarios disfavor GUT and quantum gravity theories. Leptogenesis and Affleck-Dine are viable but not well understood [62].

The sixth baryogenesis theory is CPT violation. The CPT theorem is invalid at the Planck scale [63]. The CPT theorem states the laws of physics are unchanged by combined CPT operations provided locality, unitarity (sum of all possible outcomes of any event is one), and Lorentz invariance are respected. Highly curved space times such as a black hole singularity, violate CPT because of apparent violations of unitarity caused by incoming matter information disappearance [64]. From the black hole information paradox section's conclusion, incoming matter information is lost in a quark star/black hole.

A quantum mechanics axiom states the evolution of a system, or the transformation from one state to another, must be unitary. Entropy is preserved in unitary dynamics [65]. In a quark star/black hole, energy/mass quanta in Planck cubes are transformed to an energy singularity (no quanta) where quantum mechanics becomes invalid and unitarity and entropy preservation are violated. From the arrow of time section's conclusion, in a quark star to black hole transformation entropy switches from maximum to minimum (i.e. entropy is not preserved).

CPT, unitarity, and entropy preservation were violated in the highly curved space times of both the precursor universe's super supermassive black hole (energy) and its big bang white hole (energy) counterpart. Each matter particle's transformation to a super force particle and each super force to matter particle transformation violated CPT. This provided sufficient CPT violations to produce our universe's baryon to photon ratio of 6.1×10^{-10}.

QUANTUM GRAVITY THEORY

Quantum gravity theories (e.g. string theory) merge quantum mechanics and general relativity. The preceding analyses define a quantum gravity theory.

CONCLUSIONS

The proposed theory of everything united all known physical phenomena from the infinitely small (Planck cube) to the infinitely large (Super Universe). Each of 129 matter and force particles existed within a Planck cube and any universe object was representable by a volume of contiguous Planck cubes.

An inertially stabilized, universal, rectangular coordinate system was defined. Each particle was equivalently represented by a dynamic phantom point particle, its unique string, or associated Calabi-Yau membrane. String theory's six extra dimensions were the dynamic phantom point particle's position and velocity coordinates. A particle's energy was a function of its diameter and its surface hills and valley's amplitude displacement and frequency. Pauli's exclusion principle prohibited matter particles but permitted force particles to exist within the same Planck cube.

The big bang's creation sequence of 32 fundamental and supersymmetric partners was: gravitinos/gravitons, 12 superpartner forces, gluinos/gluons, 12 fundamental matter particles, wino/zinos, W/Z bosons, and photinos/photons. Matter creation coincided with both the inflationary period start time and the one to seven Planck cubes expansion. There was no reheating phase following inflation. The process of generating 16 matter particles, W/Z bosons, and their 17 associated Higgs force particles was spontaneous symmetry breaking or the Higgs mechanism. Matter particles and their associated Higgs forces were one and inseparable. Spontaneous symmetry breaking was bidirectional, supporting condensations and evaporations. The sum of eight permanent Higgs force particles' energies was dark energy, a constant, and intimately related to eight permanent matter particles including dark matter. The cosmological constant was proportional to the vacuum or dark energy density and decreased with time as our universe expanded. Dark matter consisted of a subset of two superpartner matter particles, Higgsino matter particles, and neutral heavy leptons. The percentages of baryonic matter, cold dark matter, dark energy, and neutrinos remained constant for 13.7 billion years.

There were four sequential universe expansions. Entropy increase of the super force and its derivatives drove the expansion within our universe's first Planck cube. X bosons' (inflatons) latent heat drove the inflationary period's exponential expansion. Dark energy drove both the uniform and non-uniform distribution of matter expansions. String theory's seventh extra dimension was our universe's non-uniform distribution of matter expansion rate multiplied by the graviton's intergalactic propagation time.

A messenger particle's embedded clock/computer was its operational mechanism. The relative strengths of the gravitational and electromagnetic/weak forces were due to propagation factor dilution between gravitational force activation and electromagnetic/weak force creation/activation (hierarchy factor 10^{-42}).

Laws of physics and structure were universal across the Super Universe which consisted of nested universes. A black hole was redefined as a quark star (matter)/black hole (energy) both of which were "black." Our precursor universe's super supermassive quark star/black hole created our universe's "big bang" (white hole) by transferring its total energy/mass via conservation of energy. The three dimensional entropy formula for the quark star (matter) was: $S = k \log \Omega$, where $\Omega = (1/N!)[4\pi r^3/3(l_p)^3]^N$.

Entropy decreased in our precursor universe's subset volume. The maximum entropy super supermassive quark star (matter) transformed to the minimum entropy black hole (energy), "resurrecting" life. The cosmological constant problem (10^{-120}) existed because the Super Universe's radius and age were approximately 10^{50} light years and 10^{50} years, respectively.

Any universe object's intrinsic information was the content and position of all the object's contiguous Planck cubes, specifically the unique relative orientation of up quarks, down quarks, and electrons. Information was lost in star stages during quark star/black hole formation and none was emitted as Hawking radiation.

Justifications for the super supermassive quark star/black hole were; energy/mass conservation, Einstein's general relativity compliance (time symmetric), Second Law of Thermodynamics compliance, and cosmological constant problem resolution.

CPT, unitarity, and entropy preservation were violated in the highly curved space times of both the precursor universe's super supermassive black hole (energy) and its big bang white hole (energy) counterpart. Quantum mechanics was invalid in black or white (energy) holes. This provided sufficient CPT violations to produce our universe's baryon to photon ratio of 6.1×10^{-10} [66].

REFERENCES

[1] This paper significantly enhances A. A. Colella's, *A Proposed Super Unified Theory*, http://knol.google.com/k/antonio-colella/a-proposed-super-unified-theory/3h4y5c7nj2xo/6#view.

[2] From reference 1's string theory's extra dimensions section.

[3] In the future, the universal rectangular coordinate system shall originate at the "Super Universe's" big bang.

[4] B. Greene, *The Elegant Universe* (Vintage Books, New York, 2000), p. 144. Greene specifies only amplitude and wavelength. He also describes Calabi-Yau membranes as beach balls, doughnuts, and multidoughnuts, and conifold transitions as the procedure whereby membranes transition into each other, pp. 327-329.

[5] G. W. Hinshaw, http://map.gsfc.nasa.gov/universe/uni_matter.html. Mass = (Universe volume)(density) = $[4\pi(4.4 \times 10^{26}$ meters$)^3/3][9.9 \times 10^{-27}$ kilograms/meters$^3] = 3.5 \times 10^{54}$ kilograms. Near infinite is defined as finite but extremely large.

[6] Space and time are quantized similar to loop quantum gravity. The relationship between quantized matter (Planck cube) and quantum numbers will be analyzed. Specifically, the relationship between the four quantum numbers of an electron in an atom and the electron's location (Planck cube) will be extended to other elementary particles (e.g. up quark).

[7] The W/Z bosons (p_{15}) are transient matter particles with associated Higgs force particles (h_{15}) instead of Higgsino matter particles.

[8] M. Rees, Ed., *Universe*. (DK Publishing, New York, 2005), pp. 46-49.

[9] For analysis simplicity, the gluon was assumed to be one instead of eight, the W/Z bosons one instead of three (W^+, W^-, and Z^0), and the photon one instead of at least two (force carrier p_{16a} and electromagnetic radiation emission/absorption p_{16b}). Electromagnetic radiation type could be identified by frequency or a further subdivision into gamma rays p_{16b1}, X-rays p_{16b2}, etc..

[10] S. Faber, http://www.ucolick.org/~faber/ay5/**lecture**_notes/**lecture**17_doc.doc.

[11] A. H. Guth, *The Inflationary Universe* (Perseus Publishing, New York, 1997), p. 185 Fig. 10.6. Fig. 3 initialized the inflationary period start radius at $.8 \times 10^{-35}$ meters with an inflationary period exponential increase of 10^{36}. Guth's comparable values were 10^{-50} meters and 10^{49}. Liddle and Lyth specify the inflationary period exponential increase must be greater than 10^{26}. (*Cosmological Inflation and Large-scale Structure*, p 46)

[12] W/Z bosons are transient matter particles.

[13] Matter particle energies (e.g. up quark energy P_{11}), represent total energy or rest energy/mass, kinetic, and potential energies.

[14] Twelve superpartners (e.g. X bosons) and start of matter creations were separately shown in Fig. 2, but were essentially simultaneous ($<10^{-36}$ to 5×10^{-36} seconds).

[15] A. H. Guth, *The Inflationary Universe* (Perseus Publishing, New York, 1997), p. 209 Fig. 12.1, pp. 140-3.

[16] During baryogenesis, the ball initially at $h_{11} = h_{11bar} = 0$, Z =2 moves down the spontaneous symmetry breaking function equidistant between the X and Y axes. Super force particles condense into a particle (p_{11}), its associated Higgs force (h_{11}), an anti-particle (p_{11bar}), and its associated Higgs force (h_{11bar}). The four particles then evaporate back to super force energy as the ball returns to its initial position (bidirectional spontaneous symmetry breaking). During the second cycle, the ball moves down the spontaneous symmetry breaking function closer to the X axis and then back to its original position. After n cycles of this false vacuum state, the ball eventually moves to the true vacuum state ($h_{11} = -2$, $h_{11bar} = 0$, Z =1.5) where the super force condenses to the permanent particle (p_{11}) and its associated Higgs force (h_{11}).

[17] The Higgs force is not a point particle like an up quark, so detection by the Large Hadron Collider may be difficult.
[18] In the future, 15 Higgsino matter particles and their associated particles will be analyzed.
[19] A second type of bidirectional spontaneous symmetry breaking is subsequently described for the super supermassive quark star/black hole where permanent matter particles and their associated Higgs forces evaporate to super force particles.
[20] The gravitino (p_{17}) and gluino (p_{18}) were assumed to be transient particles.
[21] B. Povh, K. Rith, C. Scholz, F. Zetsche, *Particles and Nuclei* (Springer-Verlag Berlin, Heidelburg, 2008), p. 2.
[22] However, density calculations must be modified.
[23] J. P. Couchman, http://www.hep.ucl.ac.uk/~jpc/all/ulthesis/node45.html. There were effectively three branches; leptonic, hadronic, and semi-leptonic.
[24] G. Kane, *Sci. Am.* **293**, 40-48 (July 2005).
[25] Similar to the CKM matrix which describes transient and permanent quarks' weak decays, a superpartner matter matrix describes transient superpartner matter (i.e. gravitino p_{17}, gluino p_{18}) and permanent (i.e. wino/zinos p_{31}, photino p_{32}) decays.
[26] B. Kayser, http://www.pd.infn.it/~laveder/unbound/scuole/2009/DBD-09/B_Kayser-DBDmeeting-oct-2009.pdf. The NHL is referred to as a large right-handed Majorana.
[27] M. Y. Khlopov, http://www.roma1.infn.it/people/bini/seminars/khlopov.ppt.
[28] D. B. Cline, *Sci. Am.* **288**, 53 (March 2003).
[29] Dr. Michael Turner's estimate (private communication).
[30] G. W. Hinshaw, http://arxiv.org/PS_cache/arxiv/pdf/0803/0803.0732v2.pdf. (Article id. 0803.0732v2).
[31] E.J. Chaisson, http://www.tufts.edu/as/wright_center/cosmic_evolution/docs/text/text_part_5.html.
[32] B. Greene, *The Fabric of the Cosmos* (Vintage Books, New York, 2005), p. 155. The period 10^{-33} to 10^{-12} seconds was a uniform distribution of matter expansion without H_{31}, H_{32}.
[33] During the uniform distribution of matter expansion, space was defined by uniform distribution of matter expansion cubes $(p_{udme})^3$. That is, space expanded from a Planck cube $(p_l)^3$ to $(p_{udme})^3$. After 30,000 years, $(p_{udme})^3$ stopped expanding within galaxies and became static. After 30,000 years, intergalactic regions were defined by non-uniform distribution of matter expansion cubes $(p_{nudme})^3$ or dynamic cubes. That is, in intergalactic regions space expanded from $(p_{udme})^3$ to $(p_{nudme})^3$.
[34] e_r is itself a function of time because our universe decelerated during its first 8 billion years and accelerated during the last 6 billion years. Newton's gravitational force equation for dark matter during our universe's uniform expansion prior to 30,000 years was not analyzed.
[35] G. Kane, *Sci. Am.* **293**, 40-48 (July 2005). Particle mass (e.g. p_{11}) is proportional to the associated Higgs force (h_{11}) times the strength of the interaction ($p_{11}h_{11}$). If interactions are equal ($p_{11}h_{11} = p_{10}h_{10}$), the ratio of dark energy/all permanent matter = 72.6/27.4 = 2.65 may be valid for each permanent matter Higgs force particle ratio (e.g. h_{11}/p_{11} and h_{10}/p_{10}).
[36] S. M. Carroll, http://preposterousuniverse.com/writings/encyc/.
[37] A. Zichichi, http://cerncourier.com/cws/article/cern/38704.
[38]In the future; the handedness characteristic, handedness switching during Higgs force encounters, left-handed weak interactions, discrimination among multiple fermion forces, and messenger particle repetition rates will be analyzed.
[39] M.A. Thomson, http://www.hep.phy.cam.ac.uk/~thomson/lectures/partIIparticles/pp2004_qcd.pdf.
[40] C. P. Poole, *The Physics Handbook,* (John Wiley, New York, 1998), p. 365 Fig. 25-1. Electromagnetic and weak force strengths are equal under 10^{-18} meters.
[41] Micro, mini, and intermediate black holes were not analyzed.
[42] Dr. Coleman Miller (private communication). The discrepancy between the initial star mass (8 solar) and the final mass (1.38 solar or Chandrasekhar limit) is due to winds.
[43] D. Savage, http://hubblesite.org/newscenter/archive/releases/1997/01/text/.

[44] C. Carilli, *Science* **323**, 323 (2009). Galaxy to central black hole mass ratios were 30:1 in the early universe and 700:1 now.
[45] R. Irion, *Science*, **295**, 66 (2002).
[46] A. Kurkela, P. Romatschke, A. Vuorinen, http://arxiv.org/PS_cache/arxiv/pdf/0912/0912.1856v2.pdf
[47] D. Leahy, R. Ouyed, http://arxiv.org/PS_cache/arxiv/pdf/0708/0708.1787v4.pdf.
[48] J. D. Bekenstein, http://arxiv.org/PS_cache/quant-ph/pdf/0311/0311049v1.pdf.
[49] A. Dabholkar, *Current Science*, **89**, 2059 (2005).
[50] A. Hamilton, http://casa.colorado.edu/~ajsh/schww.html.
[51] B. Greene, *The Fabric of the Cosm*os (Vintage Books, New York, 2005), p. 173.
[52] Each super force particle produced one matter particle and its associated Higgs force particle. Assuming our universe consisted only of hydrogen atoms, for each atom the ratio of super force/up quark/down quark/electron/Higgs force particles was 4/2/1/1/4.
[53] The deflationary period time was approximately twice the inflationary period time because the colossally voluminous "cold" quark star (matter) transitioned to the black hole (energy), whereas the white hole (energy) transitioned to the compact "hot" quark-gluon plasma.
[54] W. A. Zajc, http://arxiv.org/PS_cache/arxiv/pdf/0802/0802.3552v1.pdf.
[55]Three permanent matter particles were represented in Fig. 6 by three step functions having finite rise times and centered at each matter particle's condensation time. A transient matter particle (e.g. top quark) would be represented by, for example, a Gaussian function centered at its condensation time and with a finite standard deviation. Our universe's matter composition at time = t, would then be the sum of 8 step and 9 Gaussian functions (16 matter and W/Z bosons) at time = t.
[56] K. Griest, http://physics.ucsd.edu/students/courses/winter2010/physics161/p161.3mar10.pdf.
[57] S. M. Carroll, http://www.livingreviews.org/lrr-2001-1.
[58] P. J. Steinhardt, N. Turok, *Endless Universe: Beyond the Big Bang* (Doubleday, New York, 2007), p 249.
[59] The super supermassive black hole consisted of a rotating, charged, doughnut shaped singularity. The circular current generated a precisely collimated near infinite magnetic dipole field (similar to Dirac's infinitely long, infinitely thin solenoid monopole) which could be misinterpreted as a magnetic monopole.
[60] J. M. Cline, http://arxiv.org/PS_cache/hep-ph/pdf/0609/0609145v3.pdf. Big bang nucleosynthesis determined η and the Wilkinson Microwave Anisotropy Probe measured it accurately.
[61] M. Shaposhnikov, http://www.physicsforums.com/archive/index.php/t-53648.html.
[62] N. Bao, P. Saraswat,
http://www.astro.caltech.edu/~golwala/ph135c/14SaraswatBaoBaryogenesis.pdf
[63] T. D. Lee, *Selected Papers, 1985-1996* (Gordon and Breach, Amsterdam, 1998), p 776, p 787.
[64] N. E. Mavromatos, http://arxiv.org/PS_cache/hep-ph/pdf/0504/0504143v1.pdf.
[65] F. Hulpke et al., *Foundations of Physics*, **36**, 479, 494 (2006).
[66] A future proposed theory of everything mathematical model should include total universe energy; kinetic (translational and rotational), and potential (electromagnetic, strong, gravitational, and energy to mass). The model should be modular (e.g. atomic) and expandable to composite objects (e.g. molecules, stars, and universes). A viable model should; describe particles via Planck cubes instead of quantum numbers, simplify by approximations (e.g. strong potential energy), and bypass multi-particle Schrödinger wave functions.
[67] I am grateful to all my formal and informal educators.