An Integrated Higgs Force Theory

AntonioAColella@gmail.com

An integrated Higgs force theory was primarily based on Higgs force requirements amplifications. Two key amplifications were a matter particle/Higgs force were one and inseparable and a matter particle/Higgs force bidirectionally condensed and evaporated from and to the super force. These amplifications were the basis of matter creation, baryogenesis, superpartner and Standard Model (SM) decays, spontaneous symmetry breaking, and stellar black hole evaporation. Additional Higgs amplifications included: our universe's 129 matter and force particles contained 64 supersymmetric Higgs particles; nine transient matter particles/Higgs forces decayed to eight permanent matter particles/Higgs forces; the Higgs force was a residual super force; and mass was given to a matter particle by its Higgs force and gravitons. The sum of eight Higgs forces associated with eight permanent matter particles was dark energy.

The essence of an integrated Higgs force theory is the intimate relationships between eight theories. Currently, these theories are independent of each other because physicists in one theory (e.g., string) worked independently of physicists in the seven other theories. The premise of an integrated Higgs force theory is without sacrificing their integrities, these eight independent existing theories are replaced by eight interrelated amplified theories. The amplifications provided interface requirements between the eight theories. Intimate relationships between the eight theories: string, Higgs forces, particle creation, baryogenesis, superpartner and SM decays, spontaneous symmetry breaking, stellar black holes, and the Super Universe or multiverse follow.

String theory has the three following major requirements. Each of 129 fundamental matter and force particles is defined by its unique closed string in a Planck cube (1). Any object in the Super Universe is defined by a volume of contiguous Planck cubes (e.g., quark star) containing fundamental matter or force particle closed strings. Super force closed string doughnut physical singularities existed at Planck cube centers at the start of the Super Universe, all precursor universes, and all universes including our universe.

Our universe's matter and force particles were created from the super force and manifested themselves primarily during matter creation. This occurred from the beginning of inflation at $t = 5 \times 10^{-36}$ s to t = 100 s and at extremely high temperatures between 10^{27} and 10^{10} K as shown in Rees's Big Bang time line (2).

Higgs force requirement amplifications included 64 associated supersymmetric Higgs particles, one for each of 16 SM matter and force particles, their 16 superpartners, and their 32 anti-particles. There were a total of 129 particle types in our universe, 128 matter and force particles plus the super force or mother particle. The 64 supersymmetric Higgs particles defined a "Super supersymmetry." If a standard or supersymmetric particle was a matter particle (e.g., up quark), its associated Higgs particle was a Higgs force. If a standard or supersymmetric particle was a force particle (e.g., sup squark), its associated Higgs particle was a Higgsino.

Matter creation was a super force particle's condensation to a matter particle and its associated Higgs force. The latter two were one and inseparable and modeled as an undersized porcupine (e.g., up quark Planck cube closed string) with overgrown spines (e.g., a three dimensional radial Higgs force quantized into Higgs force Planck cube closed strings). Extremely high temperatures between 10^{27} and 10^{10} K in our early universe caused spontaneous symmetry breaking. The Higgs force was a product not the cause of spontaneous symmetry breaking. The super force condensed into 17 matter particles/Higgs forces at 17 different temperatures. There were nine transient matter particles (top quark, bottom quark, charm quark, strange quark, tau, muon, gravitino, gluino, and W/Z's) and eight permanent matter particles (up quark, down quark, electron, electron-neutrino, muon-neutrino, tau-neutrino, zino, and photino). The zino and photino were dark matter particles. Spontaneous symmetry breaking was similar to the three bidirectional phases of H_2O cooling from steam, to water, to ice as temperature decreased from 212° to 32° F. Similarly the super force, down quark/Higgs force, up quark/Higgs force, three W/Z's/Higgs forces etc., were the same but manifested themselves differently as temperature decreased from 10^{27} to 10^{10} K. There was an intimate relationship between matter creation time and the matter particle's energy/mass or temperature (e.g., W^- at 10^{-12} s, 80 GeV, and 10^{15} K). The earlier the matter creation time, the greater was the matter particle's energy/mass. Ice also evaporated or melted to water which then evaporated to steam as temperature increased from 32^o to 212^o F. Similarly, particle creation was bidirectional as temperature increased, for example, the up quark/Higgs force and down quark/Higgs force evaporated back to the super force. By 100 seconds after the big bang, nine transient matter particles/Higgs forces decayed via evaporation/condensation cycles to and from the super force to eight permanent matter particles/Higgs forces.

The Higgs force was a residual super force which contained the mass, charges, and spin of its associated matter particle. When a matter particle (e.g., up quark) condensed from the super force, the residual super force was the Higgs force associated with the matter particle.

Spontaneous symmetry breaking was bidirectional. The super force condensed to a matter particle/Higgs force or a matter particle/Higgs force evaporated to the super force. In Beta minus decay, the down quark decayed to an up quark and a W^-. The W^- then decayed to an electron and an anti-electron-neutrino. The Beta minus decay equation produced correct results with a misunderstood process because indivisible fundamental particles such as the down quark or W^- cannot be split.

Particle decay was the evaporation of a heavy matter particle/Higgs force to the super force and the condensation of the super force to lighter and permanent matter particles/Higgs forces. In the Beta minus decay with Higgs force amplification, the down quark/Higgs force evaporated to a super force particle. Division of energy not matter occurred as one portion of the super force condensed to the up quark/Higgs force, and a second portion to the W^- particle/Higgs force. The three W/Z's (W^-, W^+, and Z^0) were transient matter particles because, for example, within 10^{-25} s of its creation, the W^- transient matter particle/Higgs force evaporated back to a super force particle. The super force then condensed into an electron/Higgs force and an anti-electron-neutrino/Higgs force. Since the W/Z's were reclassified as transient matter particles, this produced the asymmetrical number 17 instead of 16 matter particles, that is, 9 transient and 8 permanent matter particles.

Mass was given to a matter particle by its Higgs force and gravitons or gravitational force messenger particles. Graviton requirements were amplified to include embedded clocks/computers. The embedded graviton clock/computer calculated Newton's gravitational force by extracting masses of the transmitting and receiving matter particles from their Higgs forces, calculating the range factor $1/r^2$ as $1/ [(t_r - t_t) (c)]^2$ from the graviton transmission (t_t) and reception (t_r) times, and providing gravitational force to the receiving particle. Permanent Higgs forces give mass to their permanent matter particles not transient Higgs forces (e.g., that associated with W^-) because the latter exist for only 10^{-25} s.

Baryogenesis occurred for 17 transient and permanent matter particles, decay for nine transient matter particles, and spontaneous symmetry breaking for eight permanent matter particles. All three occurred during matter creation between 5×10^{-36} to 100 s and at temperatures between 10^{27} to 10^{10} degrees K. Since baryogenesis was similar for 17 matter particles and spontaneous symmetry breaking was similar for eight permanent matter particles, only up quark baryogenesis and spontaneous symmetry breaking are described. Decay is described for SM and superpartner matter particles.

Baryogenesis, superpartner/SM decays, and spontaneous symmetry breaking had the following time sequential phases:

- Baryogenesis of nine transient matter particles
- Decay of nine transient matter particles to eight permanent matter particles
- Baryogenesis and spontaneous symmetry breaking of eight permanent matter particles.

Because of the intimate relationship between matter creation time and the matter particle's energy/mass, the three phases occurred for the heaviest matter particle at the earliest matter creation time and highest energy/mass and for the lightest matter particle at the latest matter creation time and lowest energy/mass.

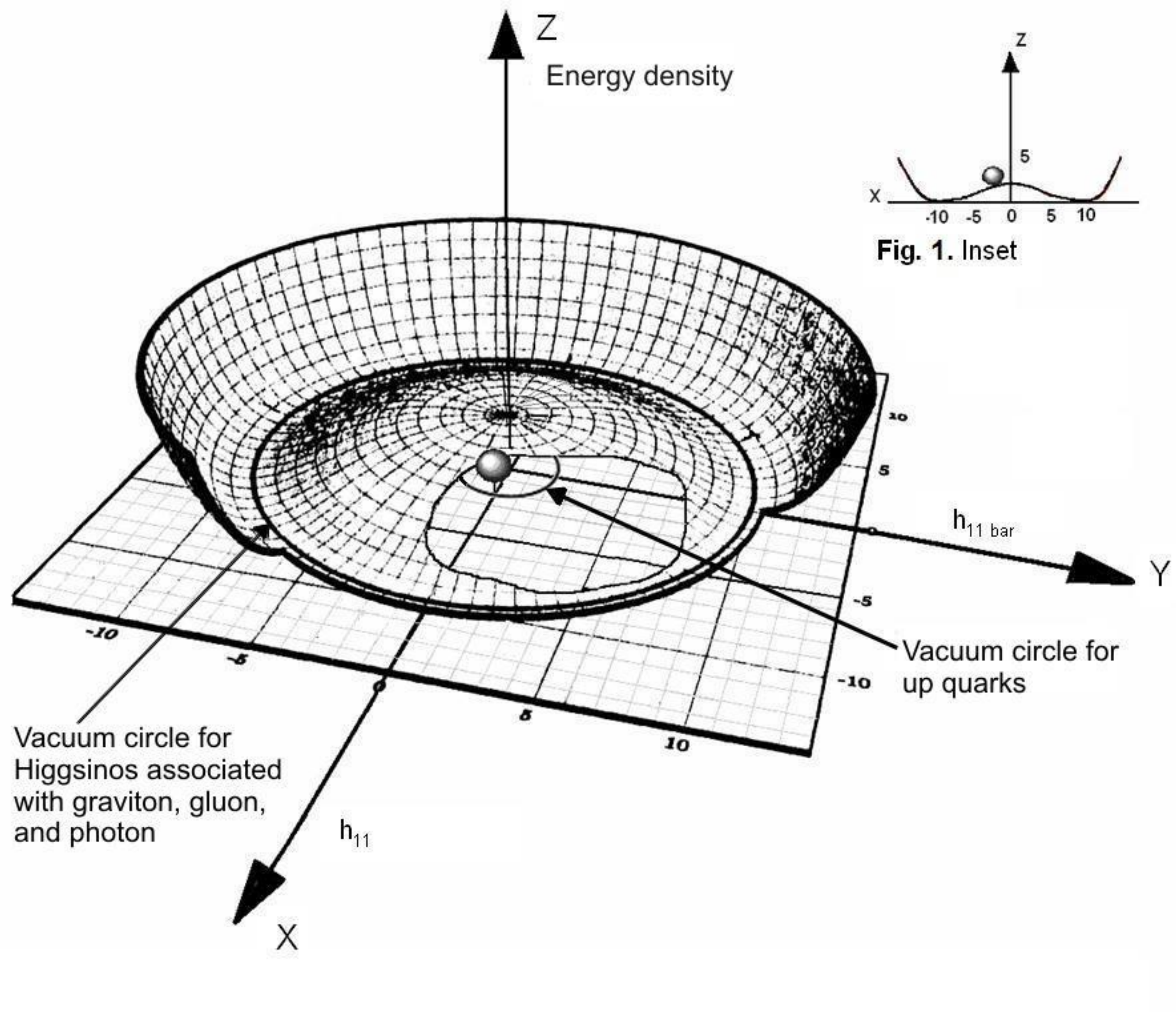


Fig. 1. Up quark baryogenesis and spontaneous symmetry breaking.

Baryogenesis of nine transient matter particles was similar to the permanent up quark's baryogenesis shown in Fig. 1 from Guth's amplified energy density of Higgs fields for the new inflation theory (3). The Z axis represented super force energy density allocated to up quarks/Higgs forces, the X axis a Higgs force (h_{11}) associated with an up quark, and the Y axis a Higgs force (h_{11bar}) associated with an anti-up quark. During up quark baryogenesis, the ball initially at its peak position (x = 0, y = 0, z = 2), moved down the spontaneous symmetry breaking function equidistant between the X and Y axes. Super force particles condensed into four particles (e.g., up quark, up quark Higgs force, anti-up quark, and anti-up quark Higgs force). A portion of these four particles then annihilated by evaporating back to super force particles as the ball returned to its peak position. Another portion condensed to up quarks/Higgs forces. During the second condensation/evaporation cycle, the ball moved down the spontaneous symmetry breaking function closer to the X axis than the Y axis and then back to its peak position. After n of these condensation/evaporation cycles in the false vacuum state, the ball eventually moved to the Fig. 1 ball position (x = -2, y = 0, z = 1.5) or the true vacuum state. In the true vacuum state the super force condensed totally to the up quark/Higgs force and none to the anti-up quark/Higgs force. Baryogenesis described above as n bidirectional condensation/evaporation cycles from and to the super force is significantly different than the prevailing two particle annihilation description (e.g., electron/anti-electron) to gamma ray photons.

Following baryogenesis of each of nine transient matter particles, it decayed as follows. Decays were gauge mediated spontaneous symmetry breaking where heavier matter particles/Higgs forces decayed in a cascading process to lighter energy/mass matter particles/Higgs forces and intermediate force particles. Intermediate force particles were W/Z's for SM particles and winos for supersymmetric particles (amplified requirement). For example, a SM bottom quark/Higgs force decayed to a charm quark/Higgs force and a W^-/Higgs force.

A superpartner decayed into a lower energy/mass superpartner and its intermediate force particle. The latter decayed to SM particles/Higgs forces. The decay chain ended with zinos/Higgs forces and photinos/Higgs forces of the stable Lightest Supersymmetric Particles (LSP) and SM particles/Higgs forces. Stable LSPs or lightest neutralinos also included three permanent Higgsino types. Dark matter consisted of zinos, photinos, and three permanent Higgsino types (4, 5).

Following baryogenesis and decay of nine transient matter particles, baryogenesis and spontaneous symmetry breaking of eight permanent matter particles occurred. For the up quark, there were two key ball positions in Fig. 1. When the ball was in its peak position, up quark baryogenesis had not occurred. When the ball was in the Fig. 1 position, up quark baryogenesis had occurred and super force energy density had condensed to up quarks/Higgs forces. The z coordinate of the Fig. 1 ball position was the super force energy density condensed to up quark Higgs forces. The z coordinate of the peak ball position minus the z coordinate of the Fig. 1 ball position was the super force energy density condensed to up quarks. During the hadron era, the ball moved from its peak position to the Fig. 1 position. It took 13.8 billion years for the ball to move vertically down to its current position just above the vacuum circle for up quarks. As the ball moved vertically down, the up quark's Higgs force (ball's x coordinate) remained constant whereas the up quark Higgs forces' energy density (ball's z coordinate) slowly decreased as our universe expanded.

There were eight baryogenesis and spontaneous symmetry breaking functions associated with eight permanent matter particles. Each had the same generic up quark Fig. 1 Mexican hat shape but each had a different peak super force energy density (peak z coordinate) and Higgs force (ball x coordinate). By 100 s, only eight permanent matter particles/Higgs forces remained.

Three permanent Higgsinos associated with three SM force particles (graviton, gluon, and photon), also experienced baryogenesis and spontaneous symmetry breaking as follows. Higgsino baryogenesis was similar to up quark baryogenesis. Super force particles condensed into four particles (e.g., Higgsino, associated SM force, anti-Higgsino, and associated SM force). In the true vacuum state the super force condensed totally to the Higgsino/SM force and none to the anti-Higgsino/SM force. By the end of Higgsino baryogenesis, the ball position in the Higgsino version of Fig. 1 was at x = -10, y = 0, z = 0 and on the vacuum circle for Higgsinos associated with the zero energy graviton, gluon, and photon. All a super force particle's energy condensed to a Higgsino and none to its associated force particle (graviton, gluon, or photon).

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 was the gravitational constant and c the speed of light (6). Vacuum or dark energy density was the sum of eight permanent Higgs force energy densities and decreased with time along with the cosmological constant as our universe expanded.

All 128 matter and force particles complied with conservation of energy/mass accountability. Accountability of our universe's total 10^{54} kg of energy by the end of matter creation at t = 100 s was as follows.

Nine transient matter particles (top quark, bottom quark, charm quark, strange quark, tau, muon, gravitino, gluino, and W/Z's) and their nine associated Higgs forces for a total of 18 particles accounted for 0%. By 100 s, nine transient matter particles/Higgs forces evaporated and condensed (decayed) to eight permanent matter particles/Higgs forces.

X bosons or inflatons consisted of 12 transient superpartner forces and their 12 associated Higgsinos for a total of 24 particles. X bosons or inflatons accounted for 0% because all their energy expanded our universe during inflation.

By the end of matter creation at t = 100 s and at a temperature of 10^{10} K, all anti-particles had been eliminated by baryogenesis or inflation (12 anti-Higgsinos and their 12 associated superpartner forces) for a total of 64 particles.

Twenty two permanent matter and force particles remained. Three SM force messenger particles (graviton, gluon, and photon) existed but accounted for 0%. Even though in transit photons contained radiation energies at t = 100 s, these photons were assumed to contain zero energy. Transmitted radiation energies were allocated to transmitting particles until the radiation was received and then allocated to receiving particles.

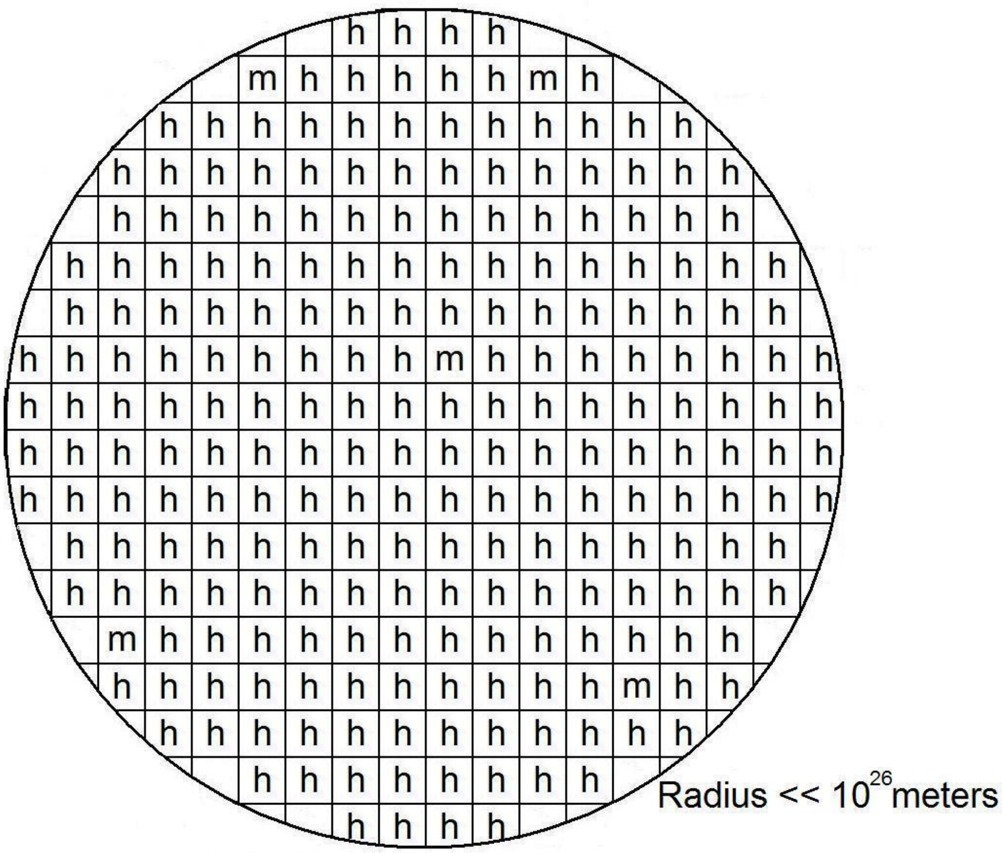
Three types of matter and force particles with energy/masses remained at t = 100 s: atomic/subatomic matter, dark matter, and dark energy. Atomic/subatomic matter or six permanent matter particles (up quark, down quark, electron, electron-neutrino, muon-neutrino, and tau-neutrino) constituted 5% of our universe's energy/mass. Dark matter or the zino, photino, and three permanent Higgsino types constituted 26% of our universe's energy/mass. Dark energy or eight Higgs forces associated with eight permanent matter particles (up quark, down quark, electron, electron-neutrino, muon-neutrino, tau-neutrino, zino, and photino) constituted 69% of our universe's energy/mass (7).

Currently a stellar black hole is defined as a space-time region where gravity is so strong not even light can escape and having no support level below neutron degeneracy pressure. Also, an inconsistency in black hole definitions exists. A stellar black hole contains a singularity with minimum area and a maximum event horizon area with maximum entropy (8).

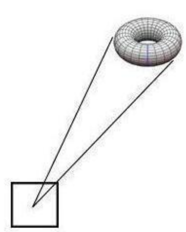
Stellar black hole theory was amplified to include a quark star (matter) and black hole (energy), both of which were "black." Their differences were a quark star (matter) had mass, volume, near zero temperature, permanence, and maximum entropy. In contrast, its associated black hole (energy) had energy, minimum volume, near infinite temperature, transientness, and minimal entropy. At the center of each of our universe's 100 billion galaxies was a supermassive quark star (matter) containing between 10^6 and 10^{10} $M_\odot$.

Stellar gravitational collapse occurs when internal energy is insufficient to resist the star's own gravity and is stopped by Pauli's exclusion principle degeneracy pressure. If the star is less than 8 $M_\odot$, it gravitationally collapses to a white dwarf supported by electron degeneracy pressure. If the star is between 8 and 20 $M_\odot$, it gravitationally collapses to a neutron star supported by neutron degeneracy pressure with a supernova explosion. If the star is between 20 and 100 $M_\odot$, it gravitationally collapses to a quark star (matter) supported by quark degeneracy pressure with a quark-nova explosion (9).

In our precursor universe of the Super Universe and before our big bang, a super supermassive quark star (matter) with our universe's energy/mass (10^{24} $M_\odot$) instantaneously evaporated, deflated, and gravitationally collapsed to its associated super supermassive black hole's (energy) doughnut physical singularity shown in Fig. 2 (10). Matter particle/Higgs force evaporation during deflation was the reverse of matter particle/Higgs force condensation in our early universe between 5 x 10^{-36} and 100 s. In Fig. 2a, a matter particle is shown as an m and a Higgs force as an h in their Planck cubes. The m represents one of eight types of permanent matter particles or three permanent Higgsino types and h represents superimposed Higgs forces of each permanent matter particle (eight types). Figure 2a is shown in two instead of three dimensions and not to scale since Planck cubes are near infinitely smaller than the super supermassive quark star (matter). At approximately one second before t = 0, the super supermassive quark star (matter) swallowed an additional matter particle and the quark degeneracy pressure threshold was exceeded. At the super supermassive quark star's (matter) center, a single electron-neutrino/Higgs force was subjected to extremely high pressure and temperature caused by matter particles above it. The electron-neutrino/Higgs force evaporated to the super force, incrementally increasing the super supermassive quark star (matter) center's temperature. A chain reaction began which instantaneously evaporated, deflated, and collapsed the super supermassive quark star (matter) to a super supermassive black hole (energy) shown in Fig. 2b. The super supermassive black hole (energy) or super force doughnut physical singularity was a Kerr-Newman black hole. Via conservation laws of energy/mass, charge, and angular momentum, the energy/mass, charge, and spin of the doughnut physical singularity was distributed to the energy/masses, charges, and spins of fundamental particles, atoms, stars, and galaxies in our universe (11).



(a) Super supermassive quark star (matter) at t=-1 second



(b) Super supermassive black hole (energy) at t=0

Fig. 2. Super supermassive quark star (matter) collapse to a super supermassive black hole (energy).

In Fig. 2a, the super supermassive quark star (matter) existed until approximately one second before our universe's start. The Hawking temperature of the super supermassive quark star (matter) having our universe's mass $M = 10^{23}$ $M_{\odot}$, was $T=10^{-7}$ ($M_{\odot}$ /M) K or 10^{-30} K (12). Since the super supermassive quark star's (matter) equation of state and cold quark-gluon plasma density were unknown, its radius was estimated as << than its Schwarzschild radius or $r_s = 2GM/c^2 = (1.48 \times 10^{-27}\ \text{m kg}^{-1})(10^{23}\ M_{\odot})(2 \times 10^{30}\ \text{kg}\ M_{\odot}^{-1}) \sim 10^{26}$ m, where r_s is the Schwarzschild radius, G is the gravitational constant, c is the velocity of light, and M is mass.

Deflation differed from inflation because its duration was longer and had two phases. During the first deflation phase, the super supermassive quark star (matter) with a << 10^{26} m radius and a 10^{-30} K temperature, collapsed to a hot quark-gluon plasma with a radius of 8 m and a temperature of 10^{25} K. This was identical to our universe's hot quark-gluon plasma at the end of inflation. During the second deflation phase, the hot quark-gluon plasma collapsed to a spherical physical singularity. The second deflation phase was the time reverse of inflation.

In conclusion, two key Higgs force amplifications were a matter particle/Higgs force were one and inseparable and a matter particle/Higgs force bidirectionally condensed and evaporated from and to the super force. These amplifications were the basis of matter creation, baryogenesis, superpartner and SM decays, spontaneous symmetry breaking, and stellar black hole evaporation. The essence of an integrated Higgs force theory was the intimate physics relationships between eight theories. The sum of eight Higgs force energies associated with eight permanent matter particles was dark energy.

Integration of 20 interrelated amplified theories including details of this article's eight subset theories is available (10).

REFERENCES

1. B. Greene, *The Elegant Universe* (Vintage Books, New York, 2000), pp. 143-144.
2. M. Rees Ed., *Universe* (DK Publishing, New York, 2005), pp. 46-49.
3. A. H. Guth, *The Inflationary Universe* (Perseus Publishing, New York, 1997), p. 209.
4. G. Kane, *Sci. Am.* **293**, 1 (2005).
5. D. B. Cline, *Sci. Am.* **288**, 3 (2003).
6. S. M. Carroll, http://preposterousuniverse.com/writings/encyc/.
7 P. A. R. Ade *et al.*, arxiv:1502.01589v2.
8. J. D. Bekenstein, arxiv:quant-ph/0311/0311049v1.
9. D. Leahy and R. Ouyed, http://arxiv.org/PS_cache/arxiv/pdf/0708/0708.1787v4.pdf.
10. A. A. Colella, vixra:1503.0256.
11. M. J. Longo, arxiv:1104.2815.
12. K. Griest, http://physics.ucsd.edu/students/courses/winter2010/physics161/p161.3mar10.pdf.