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An intimate relationship between Higgs forces, dark matter, and dark energy

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Abstract. Our universe's eight permanent matter particles are the: up quark, down quark, electron, electron-neutrino, muon-neutrino, tau-neutrino, zino, and photino. The zino and photino are dark matter particles. Each of these eight permanent matter particles has an associated supersymmetric Higgs force. The sum of the eight Higgs force energies of these eight permanent matter particles is dark energy.

1 Introduction

An intimate relationship between Higgs forces, dark matter, and dark energy is based on an Integrated Theory of Everything (TOE). The foundations of an Integrated TOE are twenty independent existing theories. The premise of an Integrated TOE is without sacrificing their integrities; these twenty independent existing theories are replaced by twenty interrelated amplified theories. Amplifications of six of the twenty independent existing theories (particle creation, inflation, Higgs forces, spontaneous symmetry breaking, dark matter, and dark energy) are required to define an intimate relationship between Higgs forces, dark matter, and dark energy [1].

2 Particle creation/inflation

Our universe's 128 matter/force particles were created from the super force between the beginning of inflation at t = 5 x 10^{-36} s to the end of the lepton era at t = 100 s and at extremely high temperatures between 10^{27} and 10^{10} degrees K as shown in the Big Bang time line of Rees [2].

The 128 matter/force particles consisted of 16 Standard Model (SM) matter/force particles, their 16 superpartners, their 32 anti-particles, and their 64 associated supersymmetric Higgs particles. Each of the 128 matter/force particles and the super force particle existed as a unique string in a Planck cube in accordance with the essentials of superstring theory by Greene [3]. Table 1 shows the 32 SM/supersymmetric matter/force particles. There are 12 SM matter particles and 4 SM force particles. There are 4 supersymmetric matter particles and 12 supersymmetric force particles. Each of these 32 matter/force particles has one of 32 anti-particles and each of those 64 has an associated supersymmetric Higgs particle (see Higgs forces section). Eight of the created matter particles were permanent and included six atomic/subatomic matter particles (up quark, down quark, electron, electron-neutrino, muon-neutrino, and tau-neutrino) and two dark matter particles (zino and photino). Nine of the created matter particles were transient and included the top quark, bottom quark, charm quark, strange quark, tau, muon, gravitino, gluino, and W/Z bosons. The W/Z bosons were reclassified as transient matter particles (see Higgs forces section). By the end of matter creation at t = 100 s, all nine transient matter particles had decayed to eight permanent matter particles.

Matter creation theory was amplified to be time synchronous with both the inflationary period start time (5 x 10^{-36} s) and the one to seven Planck cubes energy to matter expansion. Since matter particles existed in Planck cubes, matter could not exist when our universe was smaller than a Planck cube or when our universe's radius was smaller than .8 x 10^{-35} m, see fig. 1. The one to seven Planck cubes energy to matter 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 super force particles which condensed into six matter particles in the six contiguous Planck cubes. The first matter shell was then pushed out, and a second matter particle Planck cube shell condensed between the center Planck cube and the first matter shell. This process continued until enough shells with enough Planck cubes

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existed to accommodate all our universe's matter particles. By the end of inflation, the size of our universe had expanded from the size of a Planck cube to a sphere with a radius of 8 m and our universe consisted of a hot quark-gluon plasma with a temperature of approximately 10^{25} degrees K. Fig. 1 had an inflationary period start radius of .8 x 10^{-35} m with an exponential inflation factor of 10^{36} (8/.8 x 10^{-35}). Guth's comparable values were 10^{-52} m and 10^{53} (8/10^{-52}) [4]. Liddle and Lyth specified an exponential inflation factor approximately 10^{26} [5]. Thus this article's exponential inflation factor of 10^{36} was between Guth's 10^{53} and Liddle and Lyth's approximately 10^{26}.

Standard Model	Matter	Force	Supersymmetric	Matter	Force
graviton		x	gravitino	x	
gluon		x	gluino	x	
top quark	x		top squark		x
bottom quark	x		bottom squark		x
tau	x		stau		x
charm quark	x		charm squark		x
strange quark	x		strange squark		x
muon	x		smuon		x
tau-neutrino	x		tau-sneutrino		x
down quark	x		down squark		x
up quark	x		up squark		x
electron	x		selectron		x
muon-neutrino	x		muon-sneutrino		x
electron-neutrino	x		electron-sneutrino		x
W/Z bosons		x	wino/zinos	x	
photon		x	photino	x	

Table 1 Standard Model/supersymmetric matter and force particles.

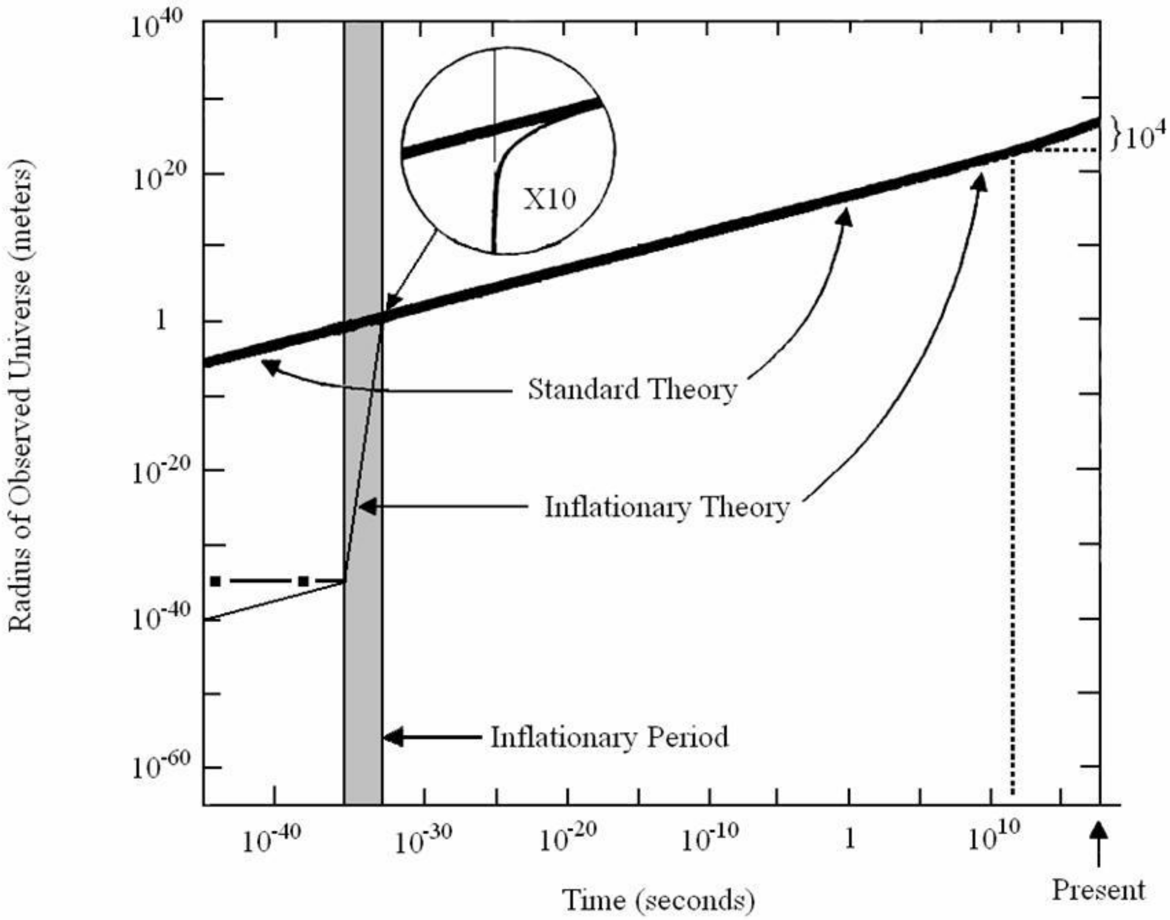

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Fig. 1. Size of the universe in the standard and inflationary theory.

3 Higgs forces

Amplifications of Higgs force theory were key to an Integrated TOE and included:

1. Sixty four associated supersymmetric Higgs particles were added
2. The Higgs force was a residual super force which contained the mass, charges, and spin of the associated matter particle
3. Matter particles and their associated Higgs forces were one and inseparable
4. Mass was given to a matter particle by its associated Higgs force and gravitational force messenger particles
5. The super force condensed into 17 matter and 17 associated Higgs forces at 17 different temperatures
6. Spontaneous symmetry breaking was bidirectional.

Sixty four associated supersymmetric Higgs particles were added, one for each of 16 SM matter/force particles, their 16 superpartners, and their 32 anti-particles. The 64 supersymmetric Higgs particles defined a "Super supersymmetry." If a standard or supersymmetric particle was a matter particle (*e.g.* an up quark or gravitino), its associated Higgs particle was a Higgs force particle. If a standard or supersymmetic particle was a force particle (*e.g.* a graviton or up squark), its associated Higgs particle was a Higgsino matter particle.

The Higgs force was a residual super force which contained the mass, charges, and spin of the 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 up quark (see Spontaneous symmetry breaking/dark matter/dark energy section).

Matter particles and their associated Higgs forces were one and inseparable and modeled as an underweight porcupine with overgrown spines. A matter particle cannot exist without its associated Higgs force or vice versa. A matter particle (*e.g.* an up quark string in a Planck cube) was modeled as an underweight porcupine and the three dimensional Higgs force field as overgrown spines. The three dimensional Higgs force field could be quantized into Planck cubes containing Higgs force strings. These Higgs force Planck cubes surrounded the associated matter particle (*e.g.* up quark) and extended to infinity.

Mass was given to a matter particle by its associated Higgs force and gravitational force messenger particles. Gravitational force messenger particles were amplified to include embedded clocks/computers. The embedded clock/computer calculated Newton's gravitational force and provided it to the receiving particle. In Newton's gravitational force equation ($F = Gm_1m_2/r^2$), m_1 and m_2 were two masses, r was the range between masses, and G was the gravitational constant. The graviton computer extracted mass m_1 and the gravitational constant G from the Higgs force associated with the transmitting particle (*e.g.* up quark). Higgs force data included mass, charges, and spin of the associated matter particle and the gravitational constant. The graviton clock initiated at graviton transmission time t_t and stopped at reception time t_r. The graviton computer calculated the range factor ($1/r^2$) as $1/[(t_r - t_t)(c)]^2$. Upon graviton reception, the receiving mass m_2 (*e.g.* down quark) was extracted from its associated Higgs force. The graviton computer calculated Newton's gravitational force and provided it to the receiving particle. The gravitational force between the transmitting (*e.g.* up quark) and receiving (*e.g.* down quark) particles consisted of a continuous series of graviton messenger particles.

The super force condensed into 17 matter and 17 associated Higgs forces at 17 different temperatures. Extremely high temperatures in our early universe caused spontaneous symmetry breaking, not the Higgs force. The Higgs force was a product not the cause of spontaneous symmetry breaking. Spontaneous symmetry breaking was similar to the three phase cooling from steam, to water, to ice. H_2O manifested itself as steam, water, and ice at different temperatures. Similarly, the super force, the up quark and its associated Higgs force, the down quark and its associated Higgs force, the electron and its associated Higgs force, etc., were the same but manifested themselves differently at extremely high but different temperatures (10^{27} to 10^{10} degrees K) in our early universe.

Spontaneous symmetry breaking was bidirectional. The super force could condense into a matter particle and its associated Higgs force or a matter particle and its associated Higgs force could evaporate to the super force. In Beta minus decay, the down quark decayed to an up quark and a W^- boson. The W^- boson then decayed to an electron and an anti-electron-neutrino. The Beta minus decay equation was at best ambiguous or at worse incorrect. Fundamental particles such as the down quark or W^- boson cannot be split because fundamental particles are indivisible.

Heavy matter particle decay is the evaporation of a heavy matter particle and its Higgs force to the super force and the condensation of the super force to lighter and stable matter particles and their Higgs forces. In a Beta minus decay with Higgs force amplification, the down quark and its associated Higgs force evaporated to the super force. Division of energy not matter occurred as one portion of the super force condensed into the up quark matter particle and its associated Higgs force, and a second portion condensed into the W^- particle and its associated Higgs force. The three W/Z bosons (W^-, W^+, and Z^0) were transient matter particles not bosons because, for example, within 10^{-25} s of its creation, the W^- transient matter particle and its associated Higgs force evaporated back to the super force. The super force then condensed into an electron matter particle, its associated Higgs force, an anti-electron-neutrino matter particle, and its associated Higgs force. Since the W/Z bosons 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.

4 Spontaneous symmetry breaking/dark matter/dark energy

The up quark spontaneous symmetry breaking function is shown in fig. 2 as amplified from Guth's figure of energy density of Higgs fields for the new inflationary theory [4]. The Z axis represented super force energy density condensed to up quarks and their associate Higgs forces, the X axis represented a Higgs force (h_{11}) associated with an up quark, and the Y axis represented a Higgs force (h_{11bar}) associated with an anti-up quark. There were two key ball positions. When the ball was in its peak position (x = 0, y = 0) none of the super force energy density had condensed. When the ball was in the fig. 2 position, all super force energy density had condensed to up quark matter particles and their associated Higgs forces. The z coordinate of the fig. 2 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. 2 ball position was the super force energy density condensed to up quark matter particles. It took less than 10^{-3} s or by the end of the hadron era for the ball to move from its peak position to the fig. 2 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

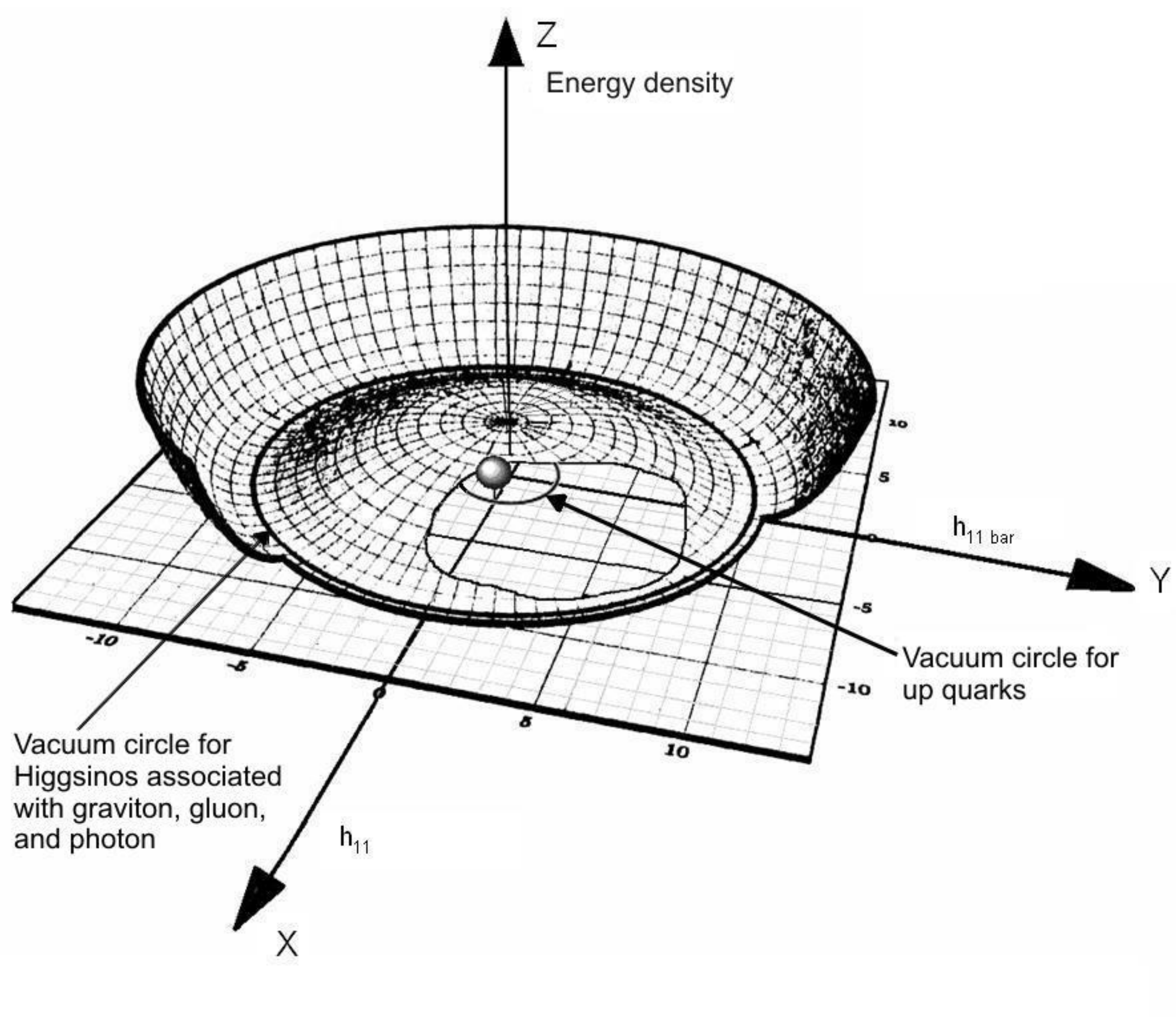

Fig. 2. Up quark spontaneous symmetry breaking.

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 17 spontaneous symmetry breaking functions associated with nine transient matter particles (top quark, bottom quark, charm quark, strange quark, tau, muon, gravitino, gluino, and W/Z bosons) and eight permanent matter particles (up quark, down quark, electron, electron-neutrino, muon-neutrino, tau-neutrino, zino, and photino). The permanent zino and photino matter particles were dark matter. Spontaneous symmetry breaking occurred for nine transient and eight permanent matter particles during matter creation in our early universe between 5×10^{-36} to 100 s and at specific temperatures between 10^{27} to 10^{10} degrees K. Each of the 17 spontaneous symmetry breaking functions had the same generic up quark fig. 2 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, all nine transient matter particles and their Higgs forces had evaporated to the super force and condensed to lighter and permanent matter particles and their Higgs forces, a process described as "decay." By 100 s, only eight permanent matter particles and their eight associated Higgs forces remained. The sum of eight Higgs force energy densities was dark energy density which slowly decreased as our universe expanded. The sum of eight Higgs force energies was dark energy. By 100 s, atomic/subatomic matter (up quark, down quark, electron, electron-neutrino, muon-neutrino, and tau-neutrino) constituted 4.9%, dark matter (zino and photino) constituted 27%, and dark energy (eight Higgs forces associated with eight permanent matter particles) constituted 68% of our university's total energy/mass [6].

All 128 matter/force particles including the added 64 associated supersymmetric Higgs particles were required for Conservation of Energy/Mass accountability. Accountability of our universe's total 10^{54} kg of energy by the end of particle creation at t = 100 s was as follows. Anti-particles of the 32 SM and supersymmetric particles and their 32 associated Higgs particles accounted for 0% of our universe's energy/mass. Baryogenesis via charge, parity, and time (CPT) violation as described by Colella [1] caused the annihilation of these 32 anti-particles and their 32 associated Higgs particles and was completed by t = 100 s. Nine transient matter particles (top quark, bottom quark, charm quark, strange quark, tau, muon, gravitino, gluino, and W/Z bosons) and their nine associated Higgs forces accounted for 0%. By 100 s, all nine transient matter particles and their nine associated Higgs forces had evaporated and condensed (decayed) to eight permanent matter particles and their Higgs forces.

Twelve transient force particles consisting of six squarks and six sleptons accounted for 0%. These 12 supersymmetric force particles also known as X bosons or inflatons expanded our universe during inflation between 5×10^{-36} to 10^{-33} s. The surge of latent heat energy from X bosons or inflatons was similar to the burst of a water filled can that froze [7]. X bosons were to the inflation period expansion as Higgs forces (dark energy) were to our universe's expansion from the end of inflation to the present time. There were also 15 Higgsinos, 3 associated with the graviton, gluon, photon and 12 associated with 6 squarks and 6 sleptons. An unknown subset of these Higgsinos (15-x) were transient and also were X bosons or inflatons. The 12 transient supersymmetric force particles and (15-x) transient Higginos disappeared by t = 100 s, and accounted for 0%. X bosons were also the supersymmetric matter particles' intermediate force comparable to SM W/Z bosons. Heavier supersymmetric matter particles (*e.g.* gravitino) and their Higgs forces evaporated to the super force which then condensed to permanent Lightest Supersymmetric Particles (*e.g.* photino), their Higgs forces, and X bosons. The X bosons evaporated to the super force which then condensed to SM particles [1] [8].

Three SM force messenger particles (graviton, gluon, and photon) accounted for 0%. Even though photons contained radiation energies at t = 100 s, the photons were assumed to contain zero energies. Transmitted radiation energies were allocated to transmitting particles until the radiation was received and then allocated to receiving particles.

Therefore, only three types of matter/force particles 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 4.9% of our universe's energy/mass. Dark matter or the zino, photino, and an unknown subset of permanent Higgsinos (x of 15) constituted 27% of our universe's energy/mass [9]. 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 68% of our universe's energy/mass.

5 Conclusions

Our universe's eight permanent matter particles were the: up quark, down quark, electron, electron-neutrino, muon-neutrino, tau-neutrino, zino, and photino. The zino and photino were dark matter particles. Dark matter may have also included the unknown subset of permanent Higgsinos (x of 15 total Higgsinos). Each of the eight permanent matter particles had an associated supersymmetric Higgs force and the sum of these eight Higgs force energies was dark energy.

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