Ad 14 April 2020 in The New York Times on page D5, and 15 April in its international edition on page 12
with notes in red added by hand

A Revolution in our Understanding of the Universe and the Mission of the Human Being

Big Bang – a Big Blunder

The cosmology based on the **Big-Bang** hypothesis has exploded into a large number of theories competing between themselves. It has developed into a flourishing **Big Business**, employing thousands of physicists united in a globally spanning network.

Too big to be abandoned in spite of 1–4!

1. A CREATIONIST BELIEF SYSTEM AMONG OTHERS. According to ancient cosmologists, the universe began as a fully developed world, which from its beginning was inhabited by plants, animals, gods, and people. Similarly, adherents of the Big-Bang hypothesis believe that the universe appeared out of nothing as a fully developed world, which from the beginning of time (t = 0) was inhabited by a complete set of elementary particles (some of which inexplicably appearing in three weights).

In "Origin" (2017), Dan Brown summarizes the teaching of modern cosmologists:
In my classroom, t > 0.
For all inquires where t = 0,
Please visit the Religion Department.

2. BUILDS ON A FALSE PREMISE, GR. The Big-Bang hypothesis was founded on the assumption that Albert Einstein's theory of gravity – general relativity (GR) – governs the expansion of the universe. Still, it has been known for a century that GR is a classical (that is, non-quantum) theory, while the universe has proven to be a quantum world. That GR and quantum theory are impossible to reconcile is generally accepted today after all attempts to formulate a quantum version of GR have failed.

3. VIOLATES THE LAW OF CONSERVATION OF ENERGY. In classical (non-quantum) physics, the law of conservation of energy cannot simultaneously be applied to local systems (bound structures, from protons and neutrons to clusters of galaxies, in which experience shows that it always holds true) and the expanding universe. By falsely assuming that this is the case in our quantum world as well, modern cosmologists have felt free to apply any theory springing from their fertile imagination to the expanding universe.

4. INFINITELY ADAPTABLE – PREDICTS NOTHING. The unlimited flexibility of the theories building on Big-Bang means that the cosmologists always have been able to adapt their theories to suit new – sometimes highly surprising – astrophysical observations. This unrestrained freedom of imagination has had a high price: The Big-Bang-based cosmologies haven't delivered any of the unambiguous answers to fundamental questions one should have the right to demand from a scientific theory of cosmology.

The Maximally Simple Model (MxSM)

5. POINTLESS PHYSICAL SPACE. The key to a scientific theory for the creation of the quantum universe we inhabit, is provided by the pressureless form of the (e. g. in weather forecasting) extensively employed flow equation of physics.

[The derivation of the pressureless equation – which contains no reference to molecules or other types of position-defining pixels or coordinate points – only requires elementary knowledge of analysis provided one first substitutes d/dx for the gradient symbol of vector analysis. See beginning of appendix A.4 "The pressureless space equation" in Book **[B]**.]

6. THE NATURE OF SPACE. A natural conclusion is that the space of our quantum universe is a kind of fluid to which the pressureless flow equation – the "space equation" – may be applied.

7. REAL SPACE VS. ABSTRACT POINTSPACE. It's now evident in what way a quantum world differs from the world described by classical physics. Classical physics assumes that real space is analogous to the abstract pointspace of mathematics, which forms a coordinate system in which position can be determined with any desired accuracy. Contrary to this assumption, the real space of physics is "pointless", lacking an intrinsic coordinate system, which means that position in motionless space is an undefinable concept. Position undefinability implies distance undefinability, which in turn leads to the experimentally observed quantum effects that can now be intuitively understood.

8. THE ETHER'S COMEBACK. Space being a fluid, means that energy is motion in space (such as whirls, oscillations, 'smoke rings', stationary or traveling waves) that never stops, but may change appearance, as the law of conservation of energy demands.

[If Albert Michelson in the 1880s and Albert Einstein in 1915 had known about the equation for a fluid void of molecules, they wouldn't have abandoned the idea of a "luminiferous aether", and the century-long confusion caused by their conclusions hadn't arisen. See beginning of home page **[A]**.]

9. THE CONSTANT B = 0.666 001 731 498. Application of the pressureless flow equation to space leads to the constant B which, in combination with the fine-structure constant α (alpha) – a numerical constant whose inverse value is 1/α = 137.036 00, and which relates the electric charge of an electron to its spin angular momentum – yields the zeroth-order approximation of the muon–electron mass ratio, 1/Bα = 205.759 223. See one-page appendices A.7 and A.21 in Book **[B]**.

[The electron appears in three "weights": as an ordinary stable electron, a heavy muon with lifetime 2.2 × 10^{–6} s (2.2 microseconds), and a superheavy tauon with lifetime 2.9 × 10^{–13} s (0.29 picoseconds).]

10. FROM SIMPLICITY TOWARD COMPLEXITY. From elementary particle physics we learn that the evolution of the universe proceeds in maximally short quantum leaps toward ever-increasing complexity. The process in which a single U-235 nucleus produces 16 offspring particles provides an instructive example. It is governed by the well-known rule for the decay of unstable (elementary or composite) particles: The average time, Δt, that a particle exists after its creation is Δt = τ, where τ (tau) is the particle's so-called lifetime (also known as mean life, or average life). If N identical particles are simultaneously created, the first decay will take place on average Δt = τ/N later, after which the subsequent decays follow the same rule, with N decrementing by one each time a particle decays. Application of the rule for particle decay to the early evolution of the universe, reveals that the newborn universe is delivered in the form of a single unstable and maximally simple (that is, neutral and spinless) "D particle". It shows that this lone primordial particle with lifetime τ_D, comprising the entire universe, in turn produces all known elementary particles in a chain reaction, which ends with the negatively charged antiproton of a mass-bearing proton–antiproton pair transforming into an electron, massless radiation, and kinetic energy. An event that signals the end of the universe's indeterminate quantum state and the beginning of the world we know.

11. THE NATURAL UNIT OF TIME. The D particle's initial lifetime τ_D, approximately equal to 10^{–19} s (with its precise value in seconds waiting to be calculated), is the natural unit in which particle lifetimes as well as the age of the universe may be specified. Scientifically and technologically advanced civilizations will know the lifetimes of the tauon and muon specified in units of τ_D. Knowledge of these two numbers should be the hallmark via which enlightened intelligent civilizations recognize each other. When describing the process of creation, it proves practical to set the natural unit of time equal to one: τ_D = 1.

[No similar unit of distance exists until the proton with a radius of about 10^{–15} m (one femtometer) appears. However, the experimentalists have failed to unambiguously pinpoint its precise value. Interestingly, this failure may have a simple explanation. See appendix A.22.4 "The proton radius" in Book **[B]**.]

12. THE SIMULATION PROGRAM. The logic of the simulation program that tracks the early evolution is simple. The source program is listed in Appendix G of Book **[B]**. Since its mathematics is essentially contained in the above-mentioned rule of decay (Δt = τ/N), the program can be understood and checked by anyone possessing fresh knowledge of basic mathematics, such as a student at senior high school who has an interest in math. The simulation shows how the universe develops from the utterly simple state of literally nothing, where neither space nor time exists, via the maximally simple physical D particle, to the universe we live in.

[The simulation program contains no freely adjustable parameters, which means that its predictions are unambiguous. It reveals the purpose of each elementary particle, and the exact time of its first appearance. See appendices G and A.16–A.21 in Book **[B]**. The simulation is approximative. Still, it results in a computed value for the mass of the muon divided by the electron mass which is over fifty times more precise than the measured value: 206.768 2832(1) and 206.768 2823(52), respectively, with the uncertainty of the last digit(s) given in parenthesis, as is customary in physics. Hopefully, a perfected method of simulation will give a precise theoretical value for the fine-structure constant α (with experimentally obtained inverse value 1/α = 137.036 00).]

The only numerical input that the simulation program requires is the values of the constant B = 0.666 001 731 498 that characterizes the spinning electron, and a corresponding constant, B_0 = 0.978 396 4019, characterizing a (today extinct) spinless electron. The crucial revelation of the simulation program is that the time of creation, t_c, is greater than zero, and coincides with the lifetime of the D particle. That is, t_c = τ_D, which, for practical reasons, is set equal to 1 in the program. For a number of other astonishing revelations delivered by the simulation program, see appendix A.18 "Surprises afforded by the simulation program" in Book **[B]**.

13. BEGINNING, DURATION, AND END OF THE D UNIVERSE. The first particle is the massive, neutral, and spinless particle described by Paul Dirac [Dirac 1971]. It "constitutes an explicit and precise solution to the relativistic harmonic oscillator" [Biedenharn, Han, and van Dam 1973]. From the state of literally nothing, in which neither space nor time exists, the oscillation starts to build up, forming simultaneously time and energy together with space created by energy. At t = t_c = 1, the oscillation peaks and the energy packet is delivered in form of the newborn universe (the "D world"). Simultaneously, the law of conservation of energy comes into force, and prevents the oscillation from dying out as rapidly as it had built up. Instead, after a lifetime of τ = 1, it decays at t = 2.

t = 0: an oscillation producing energy, time, and space starts to build up.
t = 1: the oscillation peaks and materializes in the form of a D particle.
t = 2: the D particle decays.

[The values τ = 1 and t = 2 are in reality somewhat higher because τ = 1 is the D particle's initial lifetime, and the simulation demonstrates that particle lifetimes (as well as the speed of light, c) increase over time in the global picture, where the evolution of the expanding universe is governed by the law of conservation of energy. Note that the energy content of the universe causes creation of space (with accompanying expansion of the world) to continue after the D particle has come into being.]

The decay of the D particle ignites a chain reaction that terminates after it has produced all presently existing elementary particles, with the energy of the universe carried by 2.786 billion massless background photons forming motionless diphotons together with a likewise motionless mass-bearing proton–antiproton pair, which transforms into a stable proton–electron pair, massless radiation, and kinetic energy. This event signals the end of the universe's indeterminate quantum state, immediately after which the vast majority of the background photons coalesce into a black hole with the proton forming the nucleus of condensation.

14. SM AND THE HIGGS BOSON. The simulation suggests (although doesn't prove) that the standard model (SM) shows a complete picture of the elementary particles and their interactions with each other. This means that the Higgs particle is an elementary particle among others, with specific roles assigned to it in the chain reaction leading to the present universe. It generates the bulk of the masses of the weakly interacting particles and marginal "corrections" to the masses of the electron and quarks. See the one-page summary in appendix A.21 of Book **[B]**.

15. BLACK HOLES. The appearance of kinetic energy means that the universe transforms from its original state of perfect rest to a world dominated by violently interacting black holes: The first primordial black hole (PBH) swallows nearly all energy in the tiny universe, which implies that the net energy feeding the expansion (to which the energy hidden out of sight in the PBH doesn't contribute) reduces to a minimum. The result is that the expansion all but stops, and the visible universe greatly inflates in size, with its radius suddenly increasing by a factor of about 22 000 and its volume by roughly 22 000^3, or about 10^{13} (ten trillion). See appendix B.7 in Book **[B]**. In other words, ten trillion PBHs suddenly come in visual contact with each other. The rest of the universe's history is an, at present untold, story of black holes forever growing in size, the smallest ones exploding with their released content feeding bigger black holes that grow in size and merge with each other in violent collisions that still occur from time to time, and to which the gravitational waves they generate bear testimony.

16. FROM CHAOS TO ORDER. The revolutionary lesson taught by the simulation program is that a single and maximally simple supreme law of nature, the law of conservation of energy, in detail governs everything that happens in the world – including the expansion of the universe.

[As the chain reaction that is initiated by the decay of the maximally simple D particle creates more complex elementary particles, the law of conservation of energy gives rise to other types of conservation, such as conservation of charge and conservation of spin angular momentum. Consequently, a simpler and more appropriate name for the supreme law of nature is "the law of conservation".]

Because of the complexity of macroscopic systems, it's impossible to predict their behavior via computations based on the chaotic interactions of individual elementary particles with each other. However, the supreme primary law of conservation gives rise to a secondary, all-encompassing law applicable to large collections of elementary particles; systems ranging in complexity from monatomic gases, such as helium and neon, to human beings. This law, here named the "law of change", is identical to the second law of thermodynamics – basically stating that differences in heat smooth out over time – which recently [Schneider and Kay, 1994] has been shown to have much more far-reaching consequences than previously thought. In its extended version, the law demands systems powered by concentrated high-grade energy, such as the sunshine that the life on earth depends on, to constantly strive to increase their energy consumption. Putting it differently: The law commands us to unceasingly increase our BNP, which is what we obediently are trying to do, ignoring the precautionary principle that our intelligence in vane tries to remind us of.

17. CONSEQUENCES. Knowledge of the law of change results in a new and deeper understanding of our history: why our civilization has become what it is today, and why it continues to evolve into ever higher complexity at an accelerating rate. Crucially – provided it can be spread worldwide – knowledge of the working of the law will enable us to take control of he evolution of humanity, shape our destiny, and give our children, grandchildren, and great grandchildren a future.

Our mission!

NOTE: The calculations underlying MxSM are presented in the appendices of Book **[B]**. For brief summaries of points of general interest, see appendices A.4 (first one and a half page), A.7, A.18 (first two pages), A.20, A.21, B.10, and B.11.

[A] Stig Sundman's home page **www.physicsideas.com**
[B] In **www.physicsideas.com**, click **Book** on line 2.