Grand Unification:

In the mid 1860s, James Clerk Maxwell integrated the basic equations of electromagnetism into a coherent whole, [1] a Grand Unified Theory of Electromagnetism. Newton's gravitational law suggested that gravity acts instantaneously, which contradicted Einstein's theory that nothing could exceed the speed of light. Einstein resolved the dilemma by proposing that gravity is the curvature of space. He calculated that ripples of gravity, traveling as sinusoidal waves, travel at exactly the speed of light. The result was his General Theory of Relativity [1915], which was another iteration of a theory of gravity.

Einstein showed that Maxwell's equations worked perfectly through Lorentz's transformation, but Newton's did not. Maxwell's equations were *the* basic laws of the physical world. Newton's laws, as Poincare earlier noted, were only an approximation.

Einstein wanted to expand his general theory of gravity to include Maxwell's Equations. For the last 20 years of his life, he secluded himself in a modest house in Princeton NJ, devoting all his energy to try to write an equation that united gravity and EM. He failed, but the quest for a Grand Unified Theory was to become a major scientific preoccupation.

Physicists have come to understand that the known universe is governed by the four mathematically expressed forces of gravity, electromagnetism (EM), and the weak and strong nuclear forces. The strong nuclear force holds the protons and neutrons of the nucleus together; the weak nuclear force allows neutrons to turn into protons, giving off radiation in the process. The atomic bomb releases the power of the strong nuclear force. Physicists since Einstein have been trying to understand gravity, and to reduce the expressions for the four forces of the universe to a single equation. [2]

Astronomers have discovered regions in space with enormous gravitational pull. Most believe these regions are under the influence of black holes, which are points, or singularities, so massive that gravity prevents even light from escaping. Further, as already noted, the vacuum fluctuations in energy density at every point in space are also enormous. However, Einstein's General Theory, today's standard theory of gravity, deals with large spaces and demands smooth variations in space time. Currently science has no equations that can be used to describe something that is both very massive, where normally the General Theory would apply, and very small, where normally quantum mechanics would apply. [3]

According to Professor Alex Filippenko, unification of the electro-weak and strong nuclear force will require a Grand Unified Theory (GUT), while unification of the electro-weak and strong nuclear force with gravity will require a more difficult Theory Of Everything (TOE). [4]

The search is on to develop the TOE, and some think a primary contender is the next iteration in particle physics. "String" theory, or "Super String" theory.

In 1967, Murray Gell-Mann was lecturing on the striking regularities in data pertaining to the collisions of protons and neutrons. An Italian grad student, Gabriele Veneziano, became intrigued, and found a simple math function that would describe the regularities. Why this function worked was presented in 1970 in the work of Leonard Susskind and Yoichiro Nambu. They found that Veneziano's mathematical function would arise from the underlying theory if you modeled the protons and neutrons not as points, but as tiny vibrating strings. [5]

In 1984, John Schwarz and Michael Green resolved the last major inconsistency in string theory. This did not make the theory any easier to solve, but it convinced many leading physicists- especially Edward Witten- that the theory had too many miraculous properties to ignore. String theory then jumped from laughingstock to hottest thing in physics. [6]

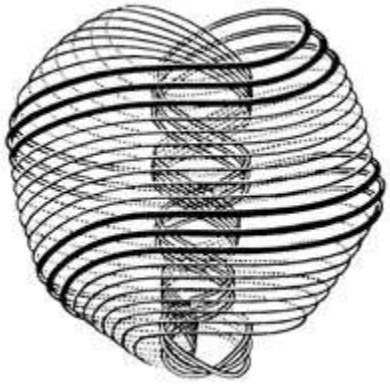
String theory asserts that all phenomena are made up not of tiny particles, but of very tiny strings of energy, which vibrate in varying ways. Edward Witten showed that the original 5 different versions of string theory were merely different perspectives on the same thing. His mathematical theory, called "M" theory, requires11 dimensions, and also predicts multiple universes. [7]

What is so alluring about String Theory? Its mathematical elegance; its aesthetics; some scientists think that certain relationships are so appealing that they must be correct. [8]

Leonard Susskind states that string theory is based on quantum mechanics and describes a system of elementary particles similar to those in our universe. However, unlike quantum mechanics, there is no experimental data in support of string theory.

What kind of experimental data could support it? Evidence of proton decay would do. The predicted rate of decay is very small; significant proton decay would be detrimental to our existence, and, perhaps fortunately, no evidence of proton decay has been found to date. [9]

Interestingly, in the esoteric tradition, as represented by Charles Leadbeater, Annie Besant, and the Theosophists in the book Occult Chemistry (1919), the most fundamental particles were described as positive and negative stringed vortices of energy, called "Anu"; the "ultimate atom". The word is Sanskrit for atom or molecule, and a title of Brahma. Needless to say, this concept of stringed vortices was not the product of advanced mathematics.



"Anu"; the "ultimate atom". [10]

The hydrogen atom was said to consist of 18 Anu units; 9 positively charged, and 9 negatively charged (antiparticles). Contemporary Anu proponents suppose the positive and negative spiral allow a transfer of energy to and from the zero point field. [11]

These purported structures would correspond to the hypothetical constituents of quarks, given the "Russian doll" nature of matter. [12] In 1974, physicists Jogesh Pati and Abdus Salam speculated that a small family of particles they called preons could explain the proliferation of quarks and leptons.

Although not currently in favor with many physicists, the preon idea has not been ruled out. In 1999, Johan Hansson and his coworkers proposed that three types of preons would suffice to build all the known quarks and leptons. [13]

The alternative physics community has developed a mathematical concept strikingly similar to the Anu concept: B.G. Sidharth, of the Centre for Applicable Mathematics & Computer Sciences in India, writes: "The physical picture is now clear: A particle can be pictured as a fluid vortex which is steadily circulating along a ring (or in three dimensions, a spherical shell) with radius equal to the Compton wavelength and with velocity equal to that of light." [14] The topic is quantum black holes, the name is the Compton Radius Vortex, described as another recent electron model by Richard Gauthier. [15]

Alternative physicist Frank D. (Tony) Smith, Jr. has used precisely the Leadbeater Theosophist figure of Anu to portray the Compton Radius Vortex. [16]

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[1] http://en.wikipedia.org/wiki/Maxwell's_equations:

Gauss's law, also known as Gauss's flux theorem, is a law relating the distribution of electric charge to the resulting electric field.

Gauss's law for magnetism is one of Maxwell's equations, the four equations that underlie classical electrodynamics. It states that the magnetic field B has divergence equal to zero, in

other words, that it is a solenoidal vector field. It is equivalent to the statement that magnetic monopoles do not exist. Rather than "magnetic charges", the basic entity for magnetism is the magnetic dipole. (Of course, if monopoles were ever found, the law would have to be modified, as elaborated below.)

Faraday's law of induction describes a basic law of electromagnetism, which is involved in the working of transformers, inductors, and many forms of electrical generators. The law states

The induced electromotive force or EMF in any closed circuit is equal to the time rate of change of the magnetic flux through the circuit.

Ampère's circuital law, discovered by André-Marie Ampère in 1826, relates the integrated magnetic field around a closed loop to the electric current passing through the loop.

[2] According to Leonard Susskind, by the 1950s, Richard Feynman, Julian Schwinger, Sin-Itiro Tomanaga and Freeman Dyson had laid the foundation for a synthesis of special relativity and quantum mechanics called Quantum Field Theory. [Leonard Susskind, *The Black Hole War* p. 7].The first and most successful expression of QFT was Quantum Electrodynamics (QED).

The EM and weak forces have been unified. In high energy interactions, we can't tell the EM force from the Weak force. Steven Weinberg et al got Nobel Prize for his development of "electro-weak" in 1979. [Notes on Teaching Company *Understanding the Universe: An Introduction to Astronomy* 2nd edition Prof Alex Filippenko. Cosmology sections Lecture 89.]

According to Paul Davies, in 1973, Sheldon Glashow and Howard Georgi published a theory in which the new electroweak force was merged with the strong gluon force to form a "grand unified force," the first Grand Unified Theory. Davies, *Superforce*, p. 130.

[3] In preparing groundwork for such equations, and a TOE, Nobel prize winner Sheldon Glashow and colleague Andrew Cohen, of Boston University in Massachusetts, have proposed a tweaking of Special Relativity to produce a "Very Special Relativity,"(VSR). This approach suggests that Lorentz symmetry (from SR) might be broken at the Plank scale, 10-35 meters, allowing QM and gravity to interact. Although such a theory might explain how neutrinos have mass but only single direction spin, no experimental evidence has been found to support it. On the other hand, if VSR were verified, it would signal serious problems for General Relativity. (GR) New Scientist 20 January 2007 Spinning Einstein by Amanda Gefter:

http://physics.bu.edu/documents/ns.pdf

[4] [Filippenko lecture 89]

[5] Leonard Mlodinow *Feynman's rainbow* Warner books 2003, p. 99.

[6] *Feynman's Rainbow* p. 169.

[7] Paul Davies *Superforce*

[8] Filippenko lecture 89 Interestingly, Susskind, with the publication of his latest books, *The Cosmic Landscape* and *The Black Hole War* is at the epicenter of current thinking about the nature of the universe. *The Cosmic Landscape* review: http://www.nyas.org/publications/readersReport.asp?articleID=48

[9] http://www.superstringtheory.com/experm/exper3.html

[10] http://www.esotericscience.org/article5a.htm

[11] http://www.esotericscience.org/article5a.htm

[12] Atoms are made of protons and neutrons (together called hadrons), along with lighter electrons. In turn, hadrons consist of particles called quarks, of which there are six varieties. In addition, there are six varieties of fundamental particles related to the electron, called leptons. http://www.nature.com/news/2007/071130/full/news.2007.292.html

[13] http://www.nature.com/news/2007/071130/full/news.2007.292.html

[14] http://xxx.lanl.gov/pdf/quant-ph/9808020.pdf

[15] http://www.irprout.it/Documenti/superluminal_helical_model.pdf

[16] http://www.valdostamuseum.org/hamsmith/worm4holes.html