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Shaping the Future of Physics with the Amplituhedron

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abstract -

Nima Arkani-Hamed's amplituhedron is a multidimensional, geometric shape that dramatically simplifies calculations of particle interactions and challenges the notion that space and time are fundamental components of reality. In my opinion, it relates to the 5th dimension, dark matter, string theory (digitized) and renormalization. These relations can be deduced via a 1919 paper by Einstein concerning gravity's role in the constitution of elementary particles, plus the hidden variables of quantum mechanics echoing string theory and assuming a digital nature. The result is a repulsive gravity usually labelled dark energy.

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The multidimensional amplituhedron is outside space-time, providing a possible way to imagine a non-spacetime world. The geometric shape can be equated with a 5th-dimensional hyperspace, and with dark matter. The space-time we live in is described by ordinary [or "real"] numbers which, when multiplied by themselves, result in positive numbers e.g. $2 \times 2 = 4$, and -2×-2 also equals 4. Inverted positive space-time becomes negative hyperspace which is described by so-called imaginary numbers that give negative results when multiplied by themselves e.g. i multiplied by itself gives -1 .

Conservation Laws say nothing's ever created (or destroyed – things only change form), so changes add to zero when "creating" the universe. Adding negative hyperspace to space-time's positive gravity and matter (I realize modern scientists have described gravity as negative), zero results.

Calculating time using imaginary numbers makes distinctions between time and space disappear. A negative 5th-dimension is described by imaginary numbers and motions of its negative particles (dark matter) are time, since time can be calculated using imaginary numbers. Time cannot be considered in isolation. Physics thinks of it as in a union with space. So imaginary numbers eliminate distinctions between space-time and the 5th dimension, permitting dark matter to exist as "ordinary" matter's scaffold.

The assumption that space-time leads to mathematical inconsistencies could be revised through the following picture of space-time (which embraces "digital string theory") - Let's borrow a few ideas from string theory's ideas of everything being ultimately composed of tiny, one-dimensional strings that vibrate as clockwise, standing, and counterclockwise currents in a four-dimensional looped superstring. We can visualize tiny, one dimensional binary digits of 1 and 0 (base 2 mathematics) forming currents in a two-dimensional program called a Mobius loop – or in 2 Mobius loops, clockwise currents in one loop combining with counterclockwise currents in the other to form a standing current. Combination of the 2 loops' currents requires connection of the two as a four-dimensional Klein bottle. This connection can be made with the infinitely-long irrational and transcendental numbers. Such

an infinite connection* translates - via bosons being ultimately composed of the binary digits of 1 and 0 depicting pi, e, $\sqrt{2}$ etc.; and fermions being given mass by bosons interacting in matter particles' "wave packets" – into an infinite number of Figure-8 Klein bottles which are, in fact, "subuniverses" (binary digits fill in gaps and adjust edges to fit surrounding subuniverses [similar to manipulation of images by computers]). Slight "imperfections" in the way the Mobius loops fit together determine the precise nature of the binary-digit currents (the producers of space-time-hyperspace, gravitational waves, electromagnetic waves, the nuclear strong force and the nuclear weak force**) and thus of exact mass, charge, quantum spin. They would also produce black holes - whose binary digits could, in the case of the sun, come from our star being compressed to 2.95 kms, in which case the pressure increase "shreds" the sun into its binary digits (its mass is relativistically converted into the energy of binary digits). Referring to a Bose-Einstein condensate, the slightest change in the binary-digit flow (Mobius loop orientation) would alter the way gravitation and electromagnetism interact, and the BEC could become a gas (experiments confirm that it does).

*If the material and immaterial universe consists of an infinite connection of transcendentals and irrationals, renormalization might be unnecessary in certain circumstances. This mathematical procedure is regarded as prerequisite for a useful theory and is used in attempts to unite general relativity with quantum mechanics to produce Quantum Gravity and the Theory of Everything. Renormalization seeks to cancel infinities – but in a literally infinite universe, retaining the infinite values might point the way to deeper understanding of the cosmos.

** When gravity waves concentrate to form matter, gravity travels from external to matter: pushes against matter (repels). Repulsive gravity is dark energy \wedge . Successive waves are re-radiated at unconcentrated strength from matter to external (opposite action to repelling wave) and attract – it must be remembered that attraction is merely a matter of perspective, since Einstein showed that attraction of two bodies of matter actually results from space-time's curvature pushing bodies.

\wedge Feeble gravity might push galaxy clusters apart in the same way that feeble sunlight propels a solar sail. In the 1970s, Robert Forward proposed two beam-powered propulsion schemes using either lasers or masers to push giant sails to a significant fraction of the speed of light. These vastly magnify the power of sunlight via Light (or Microwave) Amplification by Stimulated Emission of Radiation. How is gravity's power boosted? When Einstein penned $E=mc^2$, he used c (c^2) to convert between energy units and mass units. The conversion number is 90,000,000,000 (300,000 km/s x 300,000 km/s) which approx. equals 10^{11} . After gravity forms matter, successive gravity waves are, via gravitational lensing, concentrated 10^{24} times (to 10^{25} , weak nuclear force's strength). Then they're further magnified by the matter's density to achieve electromagnetism's strength (10^{36} times gravity's strength) i.e. 10^{25} is multiplied by Einstein's conversion factor [10^{11}] and gives 10^{36} . Galaxies move away because of the 3rd Law of Motion – to every action (gravity's push on matter) there is an equal and opposite reaction (galaxies receding as a result of what is called "dark energy").

Successive gravity waves are absorbed by the matter and radiated as longer-wavelength waves (both as electromagnetic waves - possibly gamma rays, or a microwave background – and as gravitational waves which have lost 10^{24} of their energy or strength: and are labelled “ 10^1 ”).

If space comes from bi-NARY DIGI-ts (bits) (specifically, the energy responsible for the bits is converted into space), then so does gravity (Einstein says gravity is warping of space). So as more and more energy is invested in bit production, more and more space and repelling gravity result. This causes accelerating expansion within the universe (in subuniverses), as discovered in 1998 by Saul Perlmutter, Brian Schmidt, and Adam Riess.

During absorption, something occurs with gravitational waves besides interactions producing electromagnetic and nuclear forces. Does this picture of the atom conflict with the theories of electroweak interaction (electromagnetism combined with the weak nuclear force) which won the 1979 Nobel Prize in Physics for Weinberg, Glashow and Salam? The warping of space-time in General Relativity is not separate from matter but gives an electron a mass of 0.511 MeV (mega electron volts) – technically, physicists say “0.511 MeV/c²” because an electron volt is actually a measurement of energy, and mass units equal energy units divided by c², or $m = E/c^2$ (which is $E=mc^2$ when both sides are divided by c²). ($E=mc^2$ means a tiny amount of mass can be converted into a very large amount of energy. Similarly, $m=E/c^2$ means a very large amount of energy is converted into a tiny amount of mass.) E (energy) is measured in joules (J), m is the mass in kilograms (kg; 1 kg = approx. 2.2 pounds), and c is the speed of light (about 186,282 miles/299,792.458 kilometres per second) measured in metres per second (m/s or ms⁻¹).

According to “ $E=mc^2$, Solving the Equation” (<http://www.emc2-explained.info/Emc2/Equation.htm#.UrY7RdlW2by>), “So from 1kg of matter, any matter, we get 9×10^{16} joules of energy. Writing that out fully we get: 90,000,000,000,000,000 joules (enough to power a 100 watt lightbulb for 28,519,279 years)”.

From gravitational energy equivalent to a 100 watt lightbulb burning for 28,519,279 years, only a kilogram of matter is formed. Suppose the unit ascribed to concentrated gravity’s strength of 10^{25} is the hertz (Hz), a frequency of one cycle per second. If a gamma ray is emitted from an atom, that typically accounts for more than 10^{19} Hz of the 10^{25} Hz. The remainder’s accounted for by radiation of gravitational and other electromagnetic frequencies.