

# **BEYOND EINSTEIN AND THE BIG BANG**

## **NextGen Physics and Astrophysics**

**By Solomon I. Budnik**

### About the author

He received his professor title for breakthrough discoveries in acoustics (see his book “**The Absolute Tone, the Secret of Stradivari**) comprising new theory of musical and physical acoustics. He is also the author of new theory of macroeconomics, two new theories of quantum physics and one of astrophysics to transform the world (the subjects of this book), chair in session 9 at ICP 2016: 18<sup>th</sup> International Conference on Physics, Prague, Czech Republic, scientist with many publications in physics, numerous patents and inventions in aeronautics, aerospace, renewable energy and defense.

### Introduction

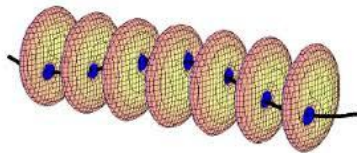
This book provides new insights in the interaction of light and matter, explains the true origin of our universe, resolves the matter-antimatter dilemma, reveals the quantum gravity creation of so-called black holes and dark matter, describes physical processes and technologies that enable the creation of quantum fusion, flexible quantum nano-computers and quantum devices for telecom and medicine, 3D remote space computers and TV displays in augmented reality, quantum propulsion with levitation and teleportation, and a nuclear accelerator in space that enables spacetime travel beyond time and space dimensions.

Breakthrough quantum technologies revealed in this book materialize the **Quantum Fusion (QF) Hypothesis** which is applicable in the fields of molecular, quantum and computational mechanics, material science, quantum physics and astrophysics, and electronics.

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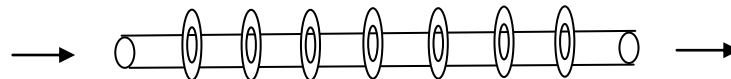
<b><u>Chapter I</u></b>	<b>QUANTUM HARMONICS IN QUANTUM ENGINEERING</b>	p. 2-21
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We show below the virtual model of a bosonic superconducting cosmic string (**fig. 1**) compared to our actual model of a **quantum harmonic system** (**fig. 2**) that enables the creation of quantum generator for quantum fusion, flexible (folded) quantum nano-computers, space computer and TV displays in quantum telecom and cyberspace, engineless quantum transmission and propelling devices for cars and aircrafts, superfluid propulsion for rockets and spacecrafts, levitation and teleportation based on three fundamental laws of physical-chemical kinetics: (1) **the law of entire equilibrium**, (2) **the law of the duality of elementary processes** (or the equality of direct and reverse transition probabilities), and (3) **the law of equal *a priori* probabilities**. It is shown that said three laws follow from the law of the symmetry of time, and furthermore, that the first and third of these laws are both derivable from the second.

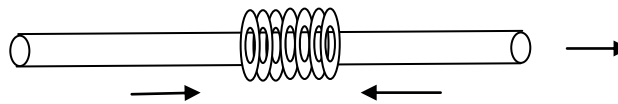


**Fig 1. Cosmic bosonic string**

Accordingly, and contrary to the common bosonic string model in **fig 1**, we model the ultracold hollow cylindrical superstring (**fig 2**) as a space-time piercing quantum tube with Casimir effect in interacting Bose-Einstein condensate inside a cylindrical tube (ref. 2 on p. 6) in overlapping counter-rotating magnetic fields (**fig. 3 here, and fig. 4 on p. 9**) and in **quantum fusion** in quantum entanglement and tunneling (**ill. 1**).. (Compare with the space-time piercing characteristics of neutrinos and their left-right counter-spinning ability).



**Fig. 2 superstring**



**Fig. 3**

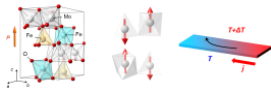


**Ill. 1**

Our tunneling superstring system in fig. 2 consists of open left entry to trap fermionic atoms in the vacuum vortex core. There, quantum Hall\* effect (QHE) is realized in a 2d electron gas subjected to a strong perpendicular magnetic field (**fig. 3 and ref. 6, 7**) under the influence of the nuclear spin fields that are then harmonized in vertex by shifting counter-rotating magnetic fields in **dynamical Casimir effect (ref. 2, 3, 4)** to unify them in a superimposed magnetic field in quantum squeezejunction (**fig. 3** above). The unified matter is then superconducted via superstring's open right exit in superpropagation due to induced Casimir and Zeeman effects and Feshbach resonance, making helium and hydrogen to interact in nuclear fusion: **hydrogen** nuclei into **helium**, whereby the matter of the fusing nuclei is converted to **heavy or dark photon** (high energy).

**"Giant thermal Hall effect in multiferroics."Nature Materials**

T. Ideue, T. Kurumaji, S. Ishiwata, and Y. Tokura . University of Tokyo.



The system in fig 3 functions similar to musical squeezebox harmonika or accordion (ill. 2) which expands and contracts its bellows by using trapped air to create pressure and vacuum and produce musical sounds.



**Ill. 2 Accordion**

Similar to accordion functions, our **quantum harmonic system** in fig. 3 shifts external magnetic fields back and forth over ultracold Majorana fermions trapped and compressed in the rotating tube of the superconducting superstring. In the lab such system can be modeled as a carbon tube (**ref. 5**) with Bose-Einstein condensate (**ref. 2, 4**) with graphene membrane (**ref. 7**) integrated within the counter-rotating **ferror- or nanomagnets\*** sliding back and forth over the tube and its trapped ultracold particles similar to Casimir plates. Note that graphene membrane is impermeable to standard gases, including helium. To make this system work as a modular cold fusion reactor, we would direct the particles beam from our **quantum harmonic generator** into the chamber with liquid helium and neon to interact there with solar neutrinos.

\*Greek scientists from the University of Crete and the Foundation for Research and Technology-Hellas (FORTH), in collaboration with U.S. scientists from Ames Research Center of NASA, have discovered a new way to create small magnets by using short laser light pulses. The discovery of the phenomenon called **Quantum Femto-Magnetism** was made by the University of Crete physics professor Ilias Perakis and his group in Greece, in co-operation with Ames Laboratory and Iowa State University physicist Jigang Wang and his team in the USA. 2016 Nobel Prize winner Duncan *Haldane* discovered how topological concepts can be used to understand the properties of **chains of small magnets**.

Our quantum model in fig 3 above represents the classical and quantum motion of photons, etc. in a rotating string. The spin motion per Bargmann-Michel-Telegdi equation is considered in the rotation tube and rotating system in acceleration of charged particles. In fact, neutral particles photons, neutrons, etc. can be accelerated by rotating tube. The specific characteristics of the mechanical systems in the rotating framework follow from the differential equations describing the massive body in the noninertial systems. (Landau, 1965). Let the Lagrange function of a point particle in the inertial system be as follows:

$$L_0 = \frac{mv^2}{2} - U \quad (1)$$

with the following equation of motion

$$m \frac{Dv_0}{dt} = - \frac{\partial U}{\partial \mathbf{r}'} \quad (2)$$

where the quantities with index 0 correspond to the inertial system. The Lagrange equations in the noninertial system is of the same form as that in the inertial one, or,

$$\frac{d}{dt} \frac{\partial L}{\partial \dot{\mathbf{r}}} = \frac{\partial L}{\partial \mathbf{r}} \quad (3)$$

However, the Lagrange function in the noninertial system is not the same as in eq. (1) because it is transformed. Specific extraordinary properties of our **quantum vacuum tube** in fig. 3 is that it simultaneously revolves, and rotates around its axis due to the forces acting on the electron in the Hydrogen atom and the centrifugal force (which appears to be the result of **conservation of angular momentum**), creating thereby atomic vortex and superfluidity of trapped supercold gaseous helium, which in quantum Hall effect becomes superfluid in **percolation** of its housing tube and acts thereby as a lubricant and coolant for external magnets sliding over our quantum tube in fig. 3. Note that bosonic quasi-particles, known as exciton-polaritons, can be created in Bose-Einstein condensate (BEC) through strong coupling between bound electron-hole pairs and the photon field. Recently, a non-equilibrium BEC and superfluidity have been demonstrated in such structures.

Our quantum tube in fig. 3 is encapsulated by hydrogen solution in Feshbach resonance, creating thereby a **dual quantum model in coherent entanglement (ref. 1)** i.e., **subquanta** within quanta. Such a quantum-subquanta introvert-extrovert duo is the building block of universal quantum web predicted by Einstein, so our quantum model on macroscale explains the phenomenon of wave particle duality in perpetuum mobile of the in-and-out flows of matter and energy of a **black hole** with curved horizon due to rotation and inflated gases in corona of matter where energy circulates in a **Möbius band** (superconductive and polarized under magnetic field) in a partially visible and mostly invisible spectrum (**dark matter**). Compare with charged particles that have been caught in the magnetic field of earth and that can move on a Möbius band.

Alfred Goldhaber of Stony Brook University in New York says that if black holes have charged plasma swirling around them, a photon's slowed movement through the plasma could make it behave as if it has mass.

Hence, our model and physical system in fig. 3 materializes the **quantum vacuum and quantum space theories** where superfluid vacuum is constructed from quanta. The assumption that the vacuum is a superfluid (or a **BEC**), enables us to derive **Schrödinger's non-linear wave equation**, also known as the **Gross-Pitaevskii equation**, from first principles. Furthermore, by treating the vacuum as an **acoustic metric**, it becomes the **analogue for general relativity's curved spacetime within regimes of low momenta**.

This kaleidoscopic matter explains the mystery of mass generation, the question of how the Higgs boson gets its mass, because it manifests the **mass generation similar to gap generation mechanism in superconductors or superfluids**. In other words, mass becomes a consequence of symmetry, vectoring quantum vortices formed in vacuum condensate.

Because our ultracold superstring in fig. 2 above is nonrelativistic, it is not constrained to the multidimensional space-time in which superstrings are usually studied in high-energy physics. So, our string is the actual **harmonic condensed matter system**, where superconductivity in **macroscopic quantum phenomena** can be studied experimentally, and quantum energy teleported.

Accordingly, this theory and model and our **THEORY OF AUGMENTED QUANTUM REALITY** enable to create a **superfluid propulsion system, quantum nano-computers, iPhones and TVs, 3D remote space computer and TV displays, nano-turbines** for cars, aircrafts and power stations, and **quantum generator** for rockets and portable cold fusion reactor. In further application of our technology, new class of vehicles can be operated in levitation and superfluid propulsion, and energy teleported.

It means that in our above shown quantum model, physical/molecular data of the object can be photonically compressed, tunneled via our quantum tube and then amplified/reassembled at a given destination. See **ref. 2**.

The eternal question "why cosmic strings aren't detected by gravitational waves" is answered in assumption that in a quantum state such mini strings never meet or spark and function at zero point gravity, in anti-gravity or repelling gravity. Such cosmic mini strings create mini black holes that can't be detected by gravitational waves. When twin superstrings of matter create a macroscale black hole, as explained in our **Theory of Unified Matter** in ch. IV, we might detect them by gravitational waves.

### **Ref. 1:**

**Streltsov, A. et al.** Measuring quantum coherence with entanglement. *Phys. Rev. Lett.* 115, 020403 (2015):

A team of researchers from India, Spain and the UK has mathematically proved that it is possible to convert an amount of ‘quantum coherence’ in a system into an equal amount of ‘quantum entanglement’. The team, which included Alexander Streltsov from ICFO-The Institute of Photonic Sciences, Barcelona, Spain, and Gerardo Adesso from the University of Nottingham, provided a mathematically rigorous approach to resolve this question using a common frame to quantify quantumness in terms of coherence and entanglement. They show that any non-zero amount of coherence in a system could be converted to entanglement via incoherent operations.

### **Ref. 2**

Shyamal Biswas, Saugata Bhattacharyya.

Amit Agarwal

03/2015

### **ABSTRACT**

“We explore **Casimir effect** on an interacting Bose-Einstein condensate (BEC) inside a cylindrical tube. The Casimir force for a confined BEC comprises of a mean field part arising from the inhomogeneity of the condensate order parameter, and a quantum fluctuation part which results from the phononic Bogoliubov excitations of the BEC. Considering Dirichlet boundary conditions for the condensate wave function as well as for the Bogoliubov excitations we explicitly calculate the Casimir force and scaling function. For low densities of the condensate, the mean field part dominates over the quantum fluctuation part, while for high densities, as the BEC order parameter becomes homogenous, the quantum fluctuations start playing a more dominant role.”

### **Ref. 3**

Observation of the dynamical Casimir effect in a superconducting circuit:

C. M. Wilson,

G. Johansson,

A. Pourkabirian,

M. Simoen,

J. R. Johansson,

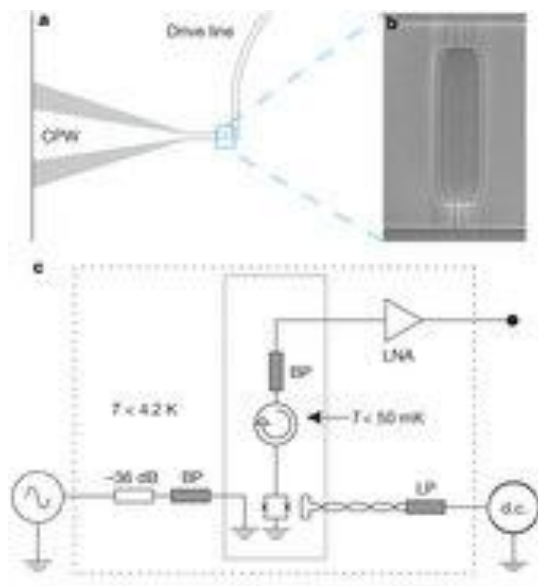
T. Duty,

F. Nori & P. Delsing

*Nature* **479**, 376–379, (17 November 2011) doi:10.1038/nature10561

One of the most surprising predictions of modern quantum theory is that the vacuum of space is not empty. In fact, quantum theory predicts that it teems with virtual particles flitting in and out of existence. Although initially a curiosity, it was quickly realized that these vacuum fluctuations had measurable consequence, producing the Lamb shift of atomic spectra and modifying the magnetic moment of the electron. This type of renormalization due to vacuum fluctuations is now central to our understanding of nature. However, these effects provide indirect evidence for the existence of vacuum fluctuations. From early on, it was discussed whether it might be possible to more directly observe the virtual particles that compose the quantum vacuum. Forty years ago, it was suggested that a mirror undergoing relativistic motion could convert virtual photons into directly observable real photons. The phenomenon, later termed the dynamical Casimir effect, has not been demonstrated previously.

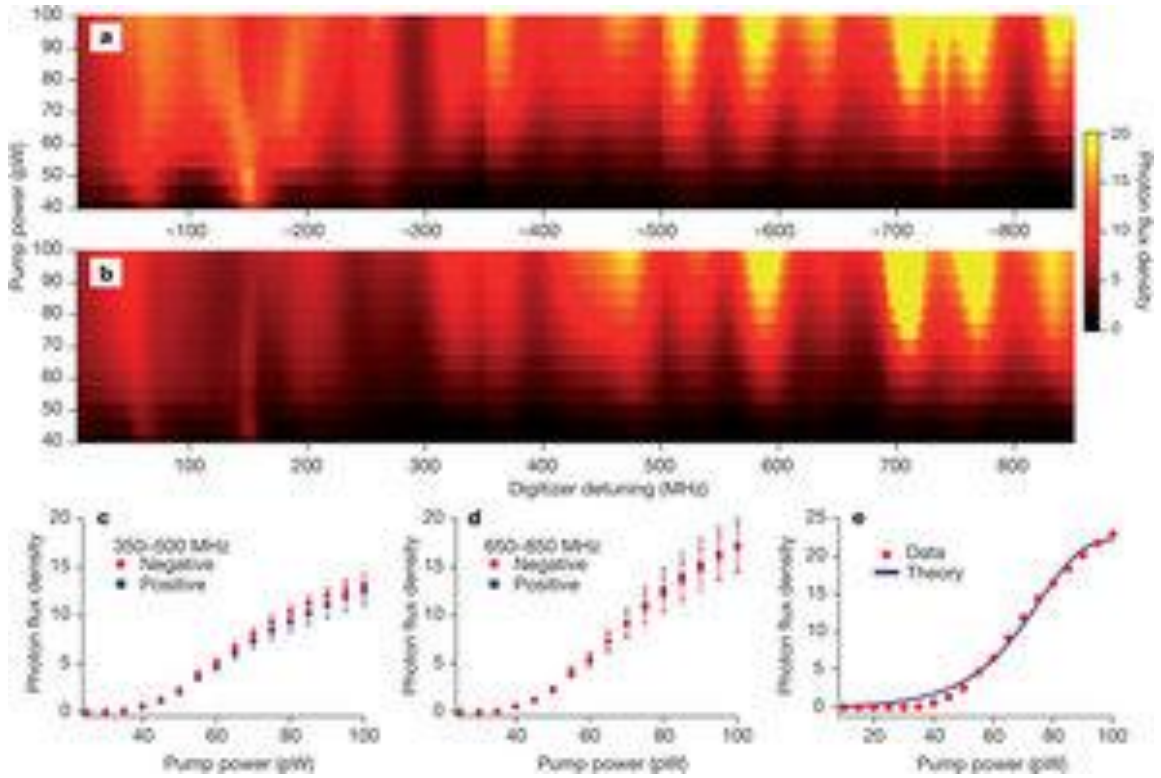
Here we observe the dynamical Casimir effect in a superconducting circuit consisting of a coplanar transmission line with a tunable electrical length. The rate of change of the electrical length can be made very fast (a substantial fraction of the speed of light) by modulating the inductance of a superconducting quantum interference device at high frequencies ( $>10$  gigahertz). In addition to observing the creation of real photons, we detect two-mode squeezing in the emitted radiation, which is a signature of the quantum character of the generation process.



**Figure 1: Experimental overview**

**a**, Optical micrograph of sample 2. Light parts are Al, which fills most of the image, while the dark parts are the Si substrate, visible where the Al has been removed to define the transmission lines. The output line is labelled CPW and the drive line enters from the top. Both lines converge near the SQUID (boxed). **b**, A scanning-electron micrograph of the SQUID. The SQUID has a vertical dimension of  $13 \mu\text{m}$  and a normal state resistance of  $218 \Omega$  ( $170 \Omega$ ) implying  $L_J(0) = 0.23$  nH ( $0.18$  nH) for sample 2 (sample 1).

A simplified schematic of the measurement set-up. The SQUID is indicated by the box with two crosses, suggestive of the SQUID loop interrupted by Josephson junctions. A small external coil is also used to apply a d.c. flux bias through a lowpass filter (LP). The driving line has 36 dB of cold attenuation, along with an 8.4–12 GHz bandpass filter (BP). The filter ensures that no thermal radiation couples to the transmission line in the frequency region where we expect DCE radiation. (For sample 1, the last 6 dB of attenuation were at base temperature.) The outgoing field of the CPW is coupled through two circulators to a cryogenic low-noise amplifier (LNA) with a system noise temperature of  $T_N \approx 6$  K. At room temperature, the signal is further amplified before being captured by two vector microwave digitizers. The dashed boxes delineate portions of the set-up at different temperatures,  $T$ , which are labeled.

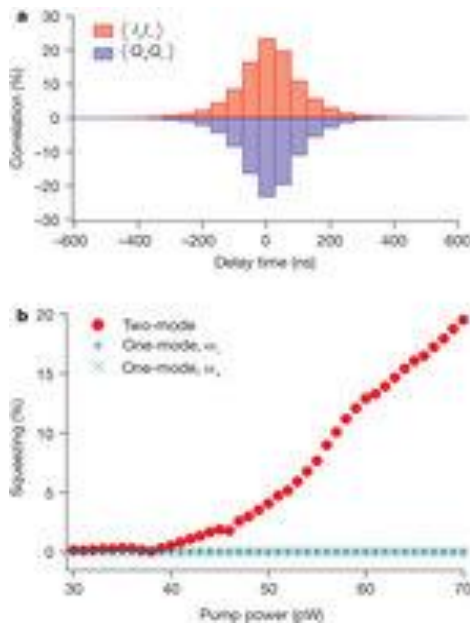


**Figure 2: Photons generated by the dynamical Casimir effect.**

Here we show the output flux of the transmission line while driving sample 1 at  $f_d = 10.30$  GHz. **a, b**, Broadband photon generation. We plot the dimensionless photon flux density,  $n_{\text{out}}$  (photons  $\text{s}^{-1} \text{Hz}^{-1}$ ), which is the measured power spectral density normalized to the photon energy,  $\hbar\omega$ , as a function of pump power and detuning,  $\delta\omega/2\pi$ . Panel **a** shows negative detunings (axis reversed), while **b** shows positive detunings. The symmetry of the spectrum is apparent. Positive and negative detunings are recorded simultaneously. The plots are stitched together from several separate scans, between which we have changed image rejection filters at the input of the analyzers. **c, d**.



The photon flux density for positive and negative detunings averaged over frequency (at fixed power) for two different symmetric bands, showing the symmetry of the spectrum. Error bars, s.d e., A section through **a** at  $\omega/2\pi = -764$  MHz, along with a fit to the full theory.



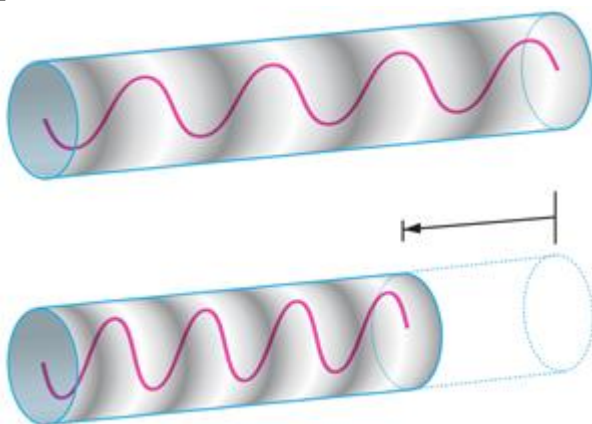
**Figure 3: Two-mode squeezing of the DCE field.**

**Ref. 4**

Viewpoint: Modeling Quantum Field Theory

Jeff Steinhauser, Department of Physics, Technion–Israel Institute of Technology, Technion City, Haifa 32000, Israel, November 26, 2012 • *Physics* 5, 131

**An analog of the dynamical Casimir effect has been achieved, where phonons replace photons, and thermal fluctuations replace vacuum fluctuations.**



**Figure 4:** A resonator for the dynamical Casimir effect. The initial length of the resonator is shown in the upper illustration. The sine wave represents one of the modes of the resonator, initially populated by vacuum fluctuations. The length of the resonator is suddenly changed (lower illustration).

The wavelength and frequency of the sinusoidal mode changes rapidly. The change is nonadiabatic, so the vacuum fluctuations are amplified, creating real photons.

Empty space is constantly fluctuating with virtual photons, which come into existence and vanish almost immediately. While these virtual photons are all around us, they cannot be observed directly. However, in a special kind of environment with spatial or temporal inhomogeneity, virtual photons can become real, observable photons by means of a variety of effects.

The challenge can be made easier by using a condensed-matter analog to the vacuum and its photon modes [1]. In *Physical Review Letters*, Jean-Christophe Jaskula and colleagues at the University of Paris-Sud, France, report that they have created such an analog for the dynamical Casimir effect, in which a rapidly changing resonator (Fig. 1 in this ref 1) produces real particles [2]. In addition to being a condensed-matter system, their observation is an analogy in another way: The real particles they observe originate from thermal fluctuations rather than quantum fluctuations of the vacuum. Their work opens the door for the observation of the quantum vacuum version, in their condensed-matter analog system.

The phenomenon studied by Jaskula and co-workers was studied previously by Engels and colleagues [3], but the interpretation was strictly classical. The real particles created were referred to as Faraday waves, oscillatory patterns that appear at half of the driving frequency. Now, Jaskula and colleagues [2] show that the waves have pair correlations in momentum space, thus making the connection with quantum-mechanical pair production and the dynamical **Casimir effect**.

In the Schwinger effect, for example, a homogeneous electric field can pull apart pairs of oppositely charged virtual particles [5]. The electric field should be strong enough to give an acceleration of  $mc^3/\hbar$ , where  $m$  is the mass of the particles. Thus, to produce an electron-positron pair, an electric field of  $10^{18}\text{V/m}$  is required, giving an acceleration of  $10^{29}\text{ m/s}^2$ . To put this in perspective, if this acceleration were maintained in the laboratory reference frame, the electron would reach the speed of light from rest within a distance of  $10\text{--}13\text{m}$ .

The event horizon of a black hole can also convert pairs of virtual particles (such as photons) to real particles, which are referred to as Hawking radiation [6]. One of the members of the pair has negative energy, and the other positive. Within the event horizon, the negative energy photon of the virtual pair can exist indefinitely, allowing the positive energy photon to exist also. This real photon travels away from the black hole as Hawking radiation. On the other hand, virtual photons can be detected by accelerating the detector of the photons (the Unruh effect) [7]. In the reference frame of the detector, the virtual photons of the vacuum will appear to be a thermal distribution of real photons. In other words, the virtual photons are Doppler shifted into reality. A detector accelerating at  $10^{20}\text{m/s}^2$  would measure a radiation temperature of only 1K.

Another way to detect the virtual photons is to rapidly change the nature of the vacuum. In the dynamical Casimir effect, a resonator has a discrete spectrum of eigenmodes [8]. These modes are populated with the virtual vacuum fluctuations. One such mode is illustrated in Fig. 1. Suddenly, the length of the resonator is changed very rapidly, at a speed which is a significant fraction of the speed of light (the experimental challenge). The change is too fast to be adiabatic, so the population of the virtual vacuum fluctuations is amplified. The extra population consists of real, observable particles.

As we can see, it is a challenge to convert virtual particles into real, observable particles. In all cases, the experimental parameters which must be achieved are formidable. But what if we could replace the speed of light with the speed of sound? In a Bose-Einstein condensate, phonons could play the role of the photons, and the condensate itself could play the role of the quantum vacuum. This is the idea of the condensed-matter analog [1]. Following the suggestion of Carusotto *et al.*, Jaskula and colleagues used a cigar-shaped Bose-Einstein condensate as a resonator for the analog of the dynamical Casimir effect [2].

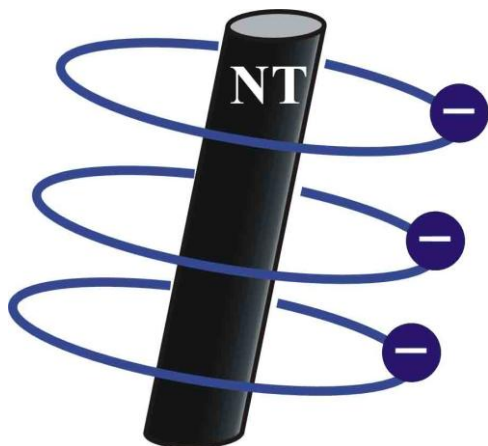
In the experiment of Jaskula *et al.*, the Bose-Einstein condensate was confined by focused laser light. The atoms forming the condensate were attracted to the bright light like insects to a lamp. In one experiment, the authors suddenly increased the laser intensity by a factor of 2, which caused an abrupt increase in the speed of sound in the condensate, and a sudden decrease in the resonator length, as indicated in Fig. 1. Each thermally populated mode was unable to follow the sudden change adiabatically. This resulted in the production of pairs of phonons with equal and opposite momenta, and a wide distribution of momenta was observed. In another experiment, the laser intensity was modulated sinusoidally, with a variation of about 10%. This resulted in pairs of phonons with frequencies equal to half of the modulation frequency, thus demonstrating the connection between the dynamical Casimir effect and parametric down-conversion of nonlinear optics. The ongoing study of the dynamical Casimir effect is part of our effort to convince ourselves that empty space is truly filled with virtual particles. If they are really there, then we want to see them in the real vacuum, as well as in a Bose-Einstein condensate analog of vacuum.

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V. V. Dodonov, "Current Status of the Dynamical Casimir Effect," *Phys. Scr.* **82**, 038105 (2010). I. Carusotto, R. Balbinot, A. Fabbri, and A. Recati, "Density Correlations and Analog Dynamical Casimir Emission of Bogoliubov Phonons in Modulated Atomic Bose-Einstein Condensates," *Eur. Phys. J. D* **56**, 391 (2010)

Ref: 5. Quantum electronic orbits discovered around carbon nanotubes



**Formation of tubular electronic states around carbon nanotubes is demonstrated in recent experiments by M. Zamkov and collaborators.**

Using two-color photoelectron emission researches can populate and subsequently observe the special group of electronic states with wave functions enclosing a carbon nanotube. These cylindrical “electronic tubes” constitute a new class of “image” states due to their **quantized angular motion**. The electron rotation about the axis of the nanotube gives rise to a centrifugal force that virtually detaches the electron charge-cloud from the tube's body. By experiencing the lattice structure parallel to the tube's axis these rings can act as powerful scanning probes of nanotube electronic properties. The first images show such electronic orbits schematically. The lower images gives a calculated shape of the radial part of the electronic wave function. This work represent the first experimental evidence for the existence of stable image-potential states orbiting carbon nanotubes. The measured lifetimes are found to be significantly longer compared to  $n = 1$  image state on graphite. This facts indicates a qualitative difference in electron decay dynamics between carbon nanotubes and planar **graphene** layers. Electrons orbiting nanotubes can be used in novel computing and memory devices and possibly qubits.

Reference: M. Zamkov, N. Woody, B. Shan, H. S. Chakraborty, Z. Chang, U. Thumm, and P. Richard James R. Macdonald Laboratory, Department of Physics, Kansas State University, Manhattan, Kansas 66506-2604, USA Phys. Rev. Lett. 93, 156803 (2004)

## **Ref. 6**

### **Abstract**

We demonstrate a possibility for exciton Bose-Einstein condensation in individual small-diameter ( $\sim 1\text{--}2$  nm) semiconducting carbon nanotubes. The effect occurs under the exciton-interband-plasmon coupling controlled by an external electrostatic field applied perpendicular to the nanotube axis. It requires fields  $\sim 1$  V/nm and temperatures below 100 K that are experimentally accessible. The effect offers a testing ground for fundamentals of condensed matter physics in one dimension and opens up perspectives to develop tunable coherent polarized light source with carbon nanotubes.

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## **Ref. 7 Impermeable Atomic Membranes from Graphene Sheets**

J. Scott Bunch, Scott S. Verbridge, Jonathan S. Alden, Arend M. van der Zande, Jeevak M. Parpia, Harold G. Craighead and Paul L. McEuen\*. Cornell Center for Materials Research, Cornell University, Ithaca, New York 14853

*Nano Lett.*, 2008, 8 (8), pp 2458–2462

**DOI:** 10.1021/nl801457b

Publication Date (Web): July 17, 2008

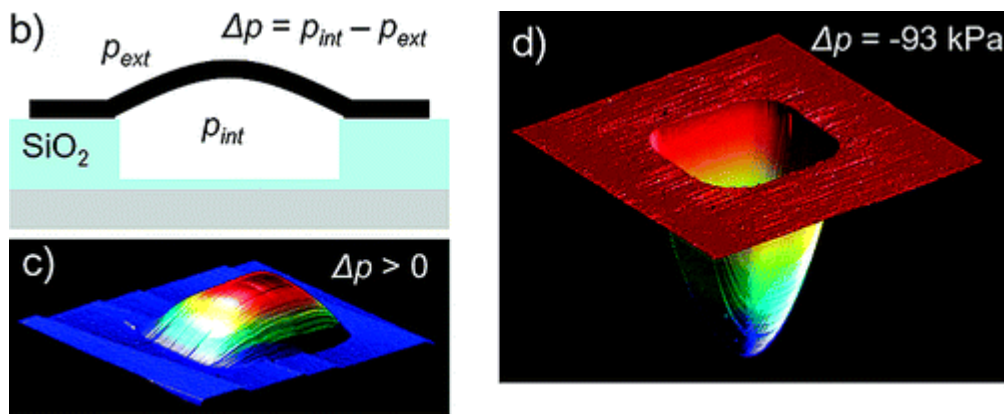
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\* Corresponding author. E-mail: [mceuen@ccmr.cornell.edu](mailto:mceuen@ccmr.cornell.edu)

The conduction and the valence band in graphene touch at two inequivalent points (K and K') at the corners of the Brillouin zone. Around those two points (termed “Dirac points”), the energy dispersion relation is linear and the electron dynamics appears thus “relativistic” where the speed of light is replaced by the Fermi velocity of grapheme ( $\approx 10^6$  F v m/sec) [1–4]. Such a unique electronic band structure has profound implications for the quantum transport in graphene. Indeed, it has recently been observed that high mobility grapheme samples exhibit an unusual sequence of quantum Hall (QH) effects. **V. Dubonos, A. A. Firsov, Nature 438, 197 (2005), Y. Zhang, Y.-W. Tan, H. L. Stormer, P. Kim, Nature 438, 201 (2005)**

In a magnetic field,  $B$ , **perpendicular** to the graphene plane, the Landau levels (LL) have an energy spectrum  $E_n = v_n B n \hbar^2$ , where  $e$  and  $h$  are electron charge and Planck's constant, and the integer  $n$  represents an electron-like ( $n > 0$ ) or a hole-like ( $n < 0$ ) LL index. The appearance of an  $n = 0$  LL at the Dirac point indicates a special electron-hole degenerate LL due to the exceptional topology of the graphene band structure. Of particular interest are the QH states near the Dirac point where strong electron correlation may affect the stability of this single-particle LL due to many-body interaction. **N. M. R. Peres, F. Guinea, and A. H. C. Neto, cond-mat/0512091**

**Abstract**

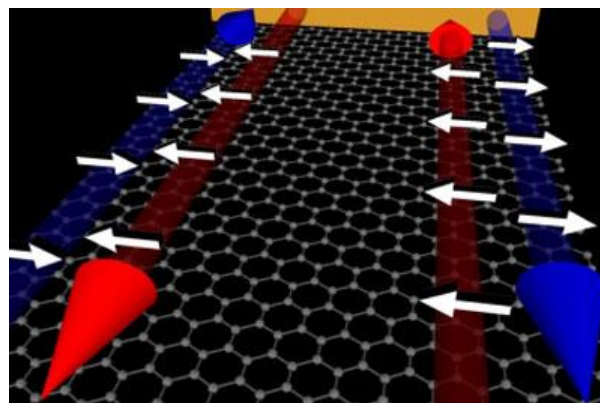


“We demonstrate that a monolayer graphene membrane is impermeable to standard gases including helium. By applying a pressure difference across the membrane, we measure both the elastic constants and the mass of a single layer of graphene. This pressurized graphene membrane is the world’s thinnest balloon and provides a unique separation barrier between 2 distinct regions that is only one atom thick.”

**Ref.: 8 Graphene + magnetic field creates exotic new quantum electronic states**

Could make graphene suitable for quantum computing for high-priority computational tasks

December 26, 2013



On a piece of graphene (the dark horizontal surface with a hexagonal pattern of carbon atoms), in a strong magnetic field, electrons can move only along the edges, and are blocked from moving in the interior. In addition, only electrons with one direction of spin can move in only one direction along the edges (indicated by the white-on-blue arrows), while electrons with the opposite spin are blocked (as shown by the white-on-red arrows). (Credit: A. F. Young et al.)

MIT research has found additional potential for graphene that could make it suitable for exotic uses such as quantum computing.

**Under an extremely powerful magnetic field and at extremely low temperature, the researchers found, graphene can effectively filter electrons according to the direction of their spin, something that cannot be done by any conventional electronic system.**

The trick:

- Turn on a powerful magnetic field perpendicular to the graphene flake. That causes current to flow only along the edge, and flows only in one direction — clockwise or counterclockwise, depending on the orientation of the magnetic field — in a phenomenon known as the quantum Hall effect.
- Turn on a second magnetic field — this time in the same plane as the graphene flake. Graphene's behavior changes yet again: electrons can now move in either direction around the conducting edge; electrons that have one kind of spin move clockwise while those with the opposite spin move counterclockwise.

### **Making circuits and transistors**

“We created an unusual kind of conductor along the edge, virtually a one-dimensional wire.” says Andrea Young, a Pappalardo Postdoctoral Fellow in MIT's physics department and the paper's lead author, The segregation of electrons according to spin is “a normal feature of topological insulators,” he says, “but graphene is not normally a topological insulator. We're getting the same effect in a very different material system.”

What's more, by varying the magnetic field, “we can turn these edge states on and off,” Young says. That switching capability means that, in principle, “we can make circuits and transistors out of these,” he says which has not been realized before in conventional topological insulators.

There is another benefit of this spin selectivity, Young says: It prevents a phenomenon called “backscattering,” which could disrupt the motion of the electrons. As a result, imperfections that would ordinarily ruin the electronic properties of the material have little effect. “Even if the edges are ‘dirty,’ electrons are transmitted along this edge nearly perfectly,” he says.



## **A graphene based quantum computer**

Professor Pablo Jarillo-Herrero, the Mitsui Career Development Associate Professor of Physics at MIT, says the behavior seen in these graphene flakes was predicted, but never seen before. This work, he says, is the first time such spin-selective behavior has been demonstrated in a single sheet of graphene, and also the first time anyone has demonstrated the ability “to transition between these two regimes.”

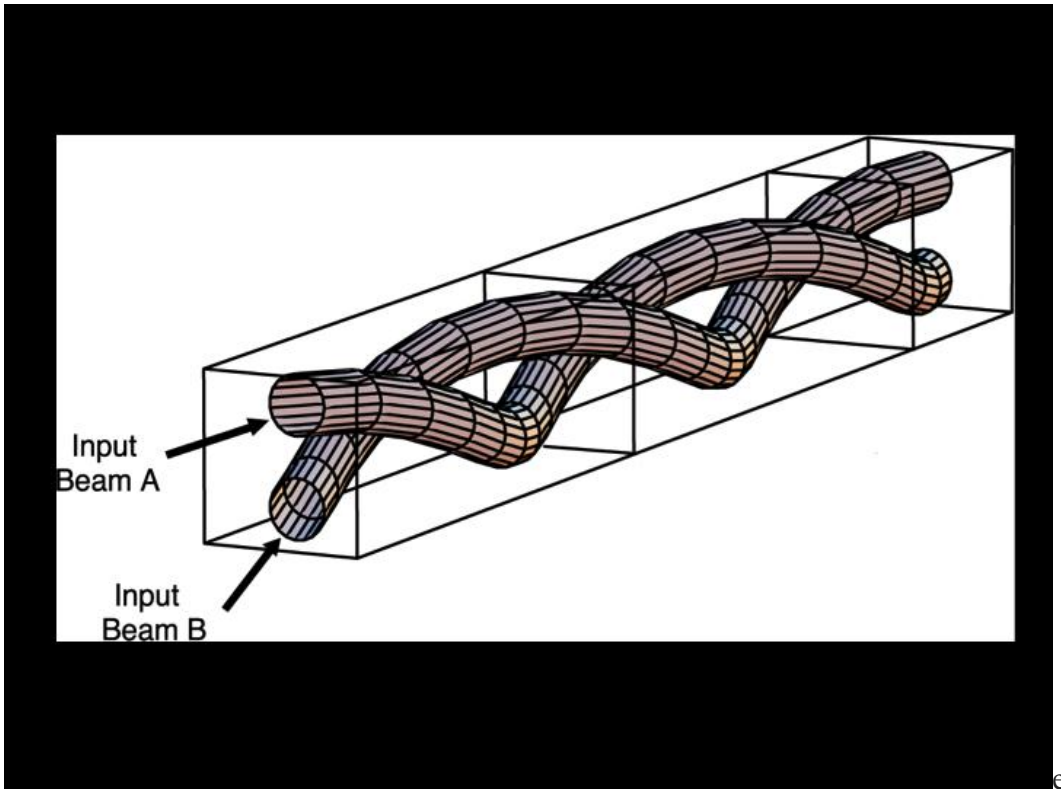
That could ultimately lead to a novel way of making a kind of quantum computer, Jarillo-Herrero says, something that researchers have tried to do, without success, for decades. But because of the extreme conditions required, Young says, “this would be a very specialized machine” used only for high-priority computational tasks, such as in national laboratories.

Ray Ashoori, a professor of physics, points out that the newly discovered edge states have a number of surprising properties. For example, although gold is an exceptionally good electrical conductor, when dabs of gold are added to the edge of the graphene flakes, they cause the electrical resistance to increase. The gold dabs allow the electrons to backscatter into the oppositely traveling state by mixing the electron spins; the more gold is added, the more the resistance goes up.

This research represents “a new direction” in topological insulators, Young says. “We don’t really know what it might lead to, but it opens our thinking about the kind of electrical devices we can make.”

The experiments required the use of a magnetic field with a strength of 35 tesla — “about 10 times more than in an MRI machine,” Jarillo-Herrero says — and a temperature of just 0.3 degrees Celsius above absolute zero. However, the team is already pursuing ways of observing a similar effect at magnetic fields of just one tesla and at higher temperatures.

Philip Kim, a professor of physics at Columbia University who was not involved in this work, says, “The authors here have beautifully demonstrated excellent quantization of the conductance,” as predicted by theory. He adds, “This is very nice work that may connect topological insulator physics to the physics of graphene with interactions. This work is a good example how the two most popular topics in condensed matter physics are connected each other.”



**3D spiral light wave concept** to constitute the photonic display in the NextGen electronic devices.

**Light beam pairs propagate and spiral about each other in the crystal.**

In re: by the rules of inertia, light particles would wiz off of an atom in a rotating three dimensional path. Is an electromagnetic wave 2-dimensional or 3-dimensional? The current "up-and-down" concept does not convince. If we look at a standard spring, we can see that it is a spiral/helix. We can also see that the side of the spring resembles a sine/cosine wave. So is an energy "wave" actually just a spiraling particle acting as a photon and appears to be an "up-and-down" wave only when viewed from the side? If true, this would explain at least two phenomena: 1.

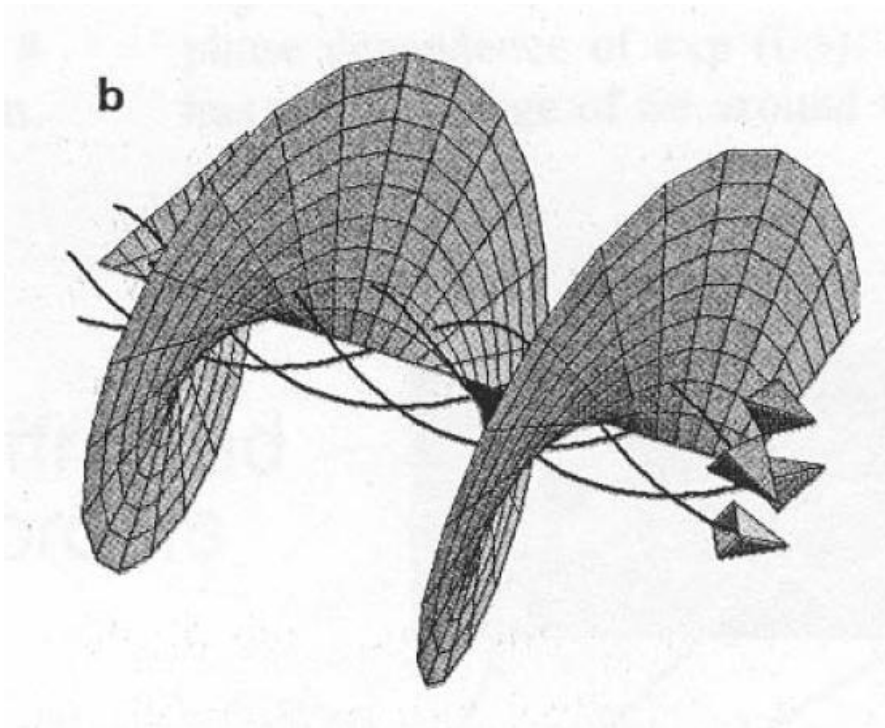
When the amplitude of a "wave" is doubled, the energy is quadrupled. In the formula for area of a circle (what would be the frontal cross-section of a spiral/helix), if one doubles the radius of the circle from 1cm to 2cm it goes from  $\pi \cdot \text{cm}^2$  to  $4\pi \cdot \text{cm}^2$ . Clearly, the so-called two dimensional wave acts as a circle when its amplitude is altered. 2. The side-view of EM radiation shows the standard sine wave and the path of the wave. The wave has the fastest vertical motion near the **x-axis** and slow vertical motion near the top and bottom. This would lead one to believe that the particle is traveling forward and backward in space relative to the side view, characteristic of spiral motion.

It is much like a ferry's wheel. If one arranges himself so that he is in-line with the wheel, the vertical speed of the cars is evident. The cars have the highest vertical motion right at 0 degrees on the wheel.

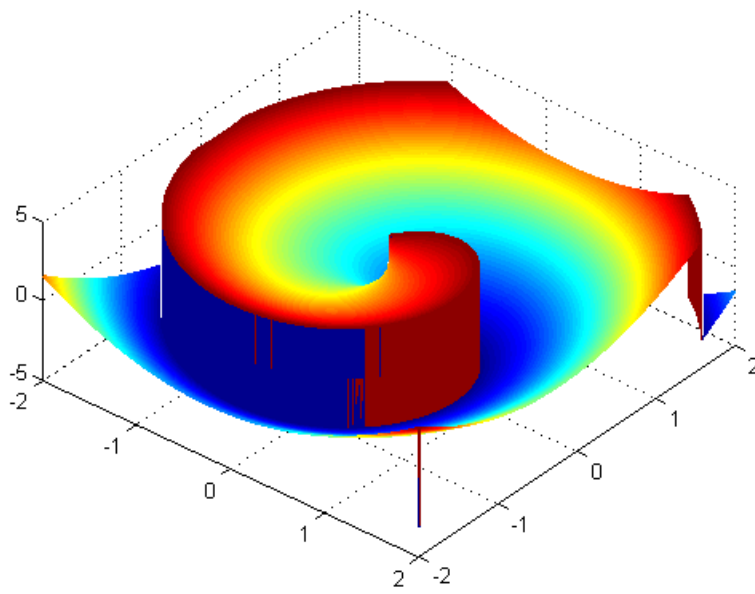
Once they near the top, their vertical speed is negligible. This is proven by the fact that at only 30 degrees, the sine measure is already at .5 radii. So if the motion of the particle on display screens exhibits slower speed at the crests and troughs of the sine wave, then there must be circular motion. If the wave is as we know it now, the particle would remain at a constant velocity on the display screen, completing a 45-->135 degree segment in the same time as a -45-->+45 degree segment. There are some interesting implications if this is true. The particle would always be traveling in the same direction, only around a helix. Is frequency determined by the angle of the particle in relation to the helix? Or its velocity... Or both? Is there an attracting body which holds the photon together? If the photon itself is traveling at the speed of light relative to the surroundings, then what is the velocity of the particle relative to the surroundings (vector creating a small, but important, amount of forward-velocity)?

**Coupling nanoscale emitters** with optical antennas enable comprehensive control of photon emission in terms of intensity, directivity and polarization. Highly directional emission of circularly polarized photons is possible from quantum dots coupled to a spiral optical antenna. The structure of the spiral antenna imprints spin state to the emitted photons. Thereby, a circular polarization extinction ratio of 10 is obtainable. Furthermore, increasing the number of turns of the spiral gives rise to higher antenna gain and directivity, leading to higher field intensity and narrower angular width of emission pattern in the far field. For a five-turn Archimedes' spiral antenna, field intensity increase up to 70-fold simultaneously with antenna directivity of 11.7 dB can be measured in the experiment. The highly directional circularly polarized photon emission from such optically coupled spiral antenna may find important applications in single molecule sensing, quantum optics information processing and integrated photonic circuits as a nanoscale spin photon source.

Consider spiral photons in Laguerre-Gauss (LG) beams. LG beams are not true hollow beams, due to the presence of magnetic fields and gradients of electric fields on beam axis. This approach paves the way to an analysis at the quantum level of the spatial structure and angular momentum properties of singular light beams.



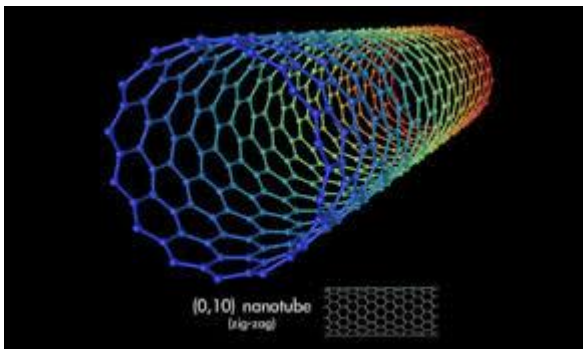
The spiraling pointing vector for LG beams



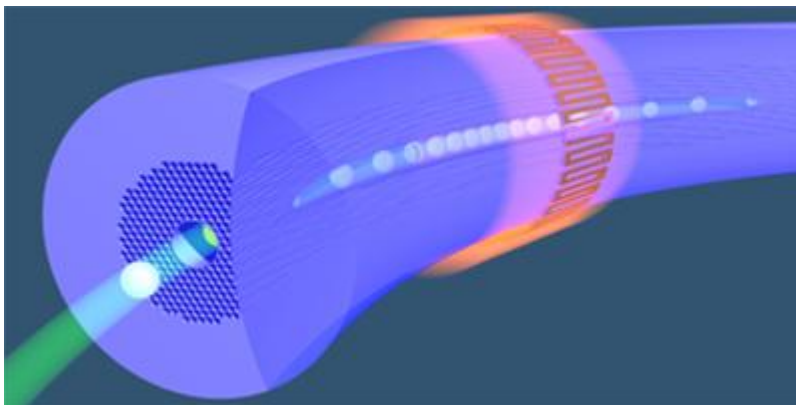
Phase dislocation on axis

## Neutral edge transport

The quantum Hall effect takes place in a two-dimensional electron gas under a strong magnetic field and involves current flow along the edges of the sample. For some particle-hole conjugate states of the fractional regime, early predictions suggested the presence of counter-propagating edge currents in addition to the expected ones. When this did not agree with the measured conductance, it was suggested that disorder and interactions will lead to counter-propagating modes that carry only energy-the so called neutral modes. In addition, a neutral upstream mode (the Majorana mode) was expected for selected wave functions proposed for the even-denominator filling  $5/2$ .



## Carbon nano tube



Particle guided in hollow-core PCF approaching a thermal hotspot, shown at several different positions

## Chapter II SELF-GRAVITATING QUANTUM SYSTEM AND DEVICE

This concerns and supplements the chapter I, **Quantum Harmonics** and its rotating and revolving quantum tube model which can self-gravitate due to the following phenomena: a system  $N$  of self-gravitating bosons or fermions can by the loss of total energy gain gravitational energy and hit up. If the particle number  $N$  is smaller than a critical number  $NF/crit$  (Plank mass/m)<sup>3</sup> for fermions and  $NB/crit$  (Plank mass/m)<sup>2</sup> for bosons, the system can heat up to temperatures and concentrate to densities such that some particles will reach a quantum ground state, functional of the total particle number. By further cooling of the system, the  $N$  particles approach the well-known fully condensed or fully degenerate configurations. For bosons, the appearance of a quantum condensed state leads to a phase transition of the first kind. For fermions or bosons the systems increase their temperature and condense to configurations for which a general relativistic treatment is mandatory. The concept of maximum temperature for a self-gravitating Bose or Fermi system is feasible:

PACS 05.30 Fk - Fermion systems and electron gas.

PACS 05.30 Jp - Boson systems.

PACS 97.10 - Stellar characteristics.

Consider also the role of the Drinfeld double  $DSU(2)$  in the context of 3D Riemannian loop quantum gravity. This constitutes our **self-gravitating quantum system** in the Fock space of the free self-gravitating field: the vacuum is the unique  $DSU(2)$  invariant state, one-particle states correspond to  $DSU(2)$  unitary irreducible simple representations and any multi-particles states are obtained as the symmetrized tensor product between simple representations. The associated quantum field is defined by the usual requirement of covariance under  $DSU(2)$ . Then, we apply a  $DSU(2)$ -invariant self-interacting potential and explicitly compute the lowest order terms (in the self-interaction coupling constant  $\lambda$ ) of the propagator and of the three-point function. Finally, we compute the lowest order quantum gravity corrections (in the Newton constant  $G$ ) to the propagator and to the three-point function.

A Bose-Einstein condensate of cold atoms is a superfluid and thus responds to rotation of its container by the nucleation of quantized vortices. If the trapping potential is strong, there is no theoretical limit to the rotation frequency one can impose to the fluid, and several phase transitions characterized by the number and distribution of vortices occur when it is increased from zero to infinity. In this note we focus on a regime of very large rotation velocity where vortices disappear from the bulk of the fluid, gathering in a central hole of low matter density induced by the centrifugal force.

The envisioned supercavity might be created as an **electro-magnetic bubble** that repels air in a magneto-gravitic propulsion system. The method makes use of H energy to create a magnetic bubble or mini-magnetosphere. The magnetosphere is produced by the injection of plasma on to the magnetic field of a small (< 1 m) dipole coil tethered to the projectile. In this way, it is possible to attain unprecedented speeds for minimal energy and mass requirements. Since the magnetic inflation is produced by electromagnetic processes, the material and deployment problems associated with the mechanical sails are eliminated.

Researchers at the University of Missouri have devised a method of creating and launching rings of plasma through open air. Now, in general, it's very easy to produce plasmas in a vacuum, and to control them with massive electromagnets. Most of our attempts at controlled nuclear fusion, which involves the creation of high-energy deuterium-tritium plasma, have required immensely powerful electromagnets to create and/or control the plasma. (See: 500MW from half a gram of hydrogen: The hunt for fusion power heats up.) The University of Missouri, however, has devised a method of creating plasma that creates its own magnetic field, which acts as a containment field as it travels through open air.

### **OUR QUANTUM CHAMBER DESIGN**

In its small design, below, it could propel small projectiles and warheads to any remote part of the earth, making guns and ballistic missiles obsolete. In a large **quantum arbalest** design per our unified matter model in ch. IV it can propel plasma into open space against asteroids, etc.

Suggested small design:

centrifuge

vacuum microwave cavity/combustion chamber

injector with hybrid cirkoni to slow down neutrons berillium reflector

H

He

lasers

rapidly rotating trapped Bose gases in magnetic vortex, capacitor is then discharged. The gap between the electrodes ionizes, turning the non-flamma. high voltage source and a large capacitor bank are used. Both are attached in series to the electrode system in the chamber.

The capacitor is loaded with as high a voltage as possible. However, a kinetically useful energy is achieved with as little as several kilojoules, making the propellant medium into a superheated conductive plasma. Associated volumetric expansion propels the projectile from the chamber at high velocity.

In medium design it could propel satellites and spacecrafts to open space without rockets.

In its large design it can propel plasma jet to any part of the earth to use its kinetic energy to annihilate any target or large area, with an impact similar to devastating kinetic impact of a large space object.

It its superfluid design, it could propel plasma cluster into open space at zero gravity.

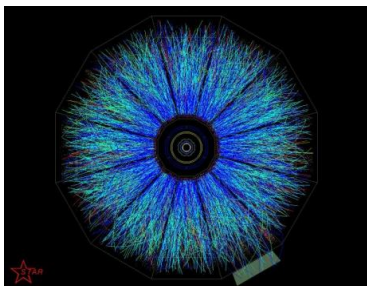


### Chapter III      THEORY OF AUGMENTED QUANTUM REALITY

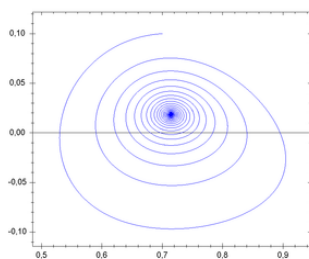
#### **(QUANTUM ELECTRONIC DISTRIBUTION SYSTEM FOR QUANTUM NANO-COMPUTERS, TVs and iPNONES, and for 3D REMOTE PHOTONIC SPACE COMPUTER/TV DISPLAYS IN LASER IMEGARY)**

We present here our quantum propagation and entanglement system for virtual reality remote space computers and TVs with photonic displays in laser activated imagery. This concept is based on **1935 Einstein-Podolsky-Rosen Argument in Quantum Theory**. Einstein maintains there (Bacciagaluppi and Valentini 2009, p. 488): “the interpretation, according to which  $|\psi|^2$  expresses the probability that *this* particle is found at a given point, assumes an entirely peculiar mechanism of action at a distance, which prevents the wave continuously distributed in space from producing an action in two places on the screen. Einstein continues: “in my opinion, one can remove this objection only in the following way, that one does not describe the process solely by the Schrödinger wave, but that at the same time **one localizes the particle during propagation.**”

We accordingly apply Einstein’s concept in our **3D quantum phase space display** (see image below) in which all possible states of a system are represented, with each possible state of the system corresponding to one unique point in the phase space of all possible values of position and momentum variables where every degree of freedom or parameter of the system is represented as an axis of a multidimensional space. The concept of phase space was developed in the late 19th century by Ludwig Boltzmann, Henri Poincaré, and Willard Gibbs.



**This image of quantum plasma is similar to our 3D quantum phase space display concept**



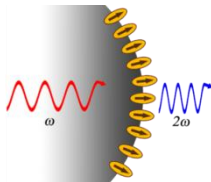
**Compare with phase space of a dynamic system with focal instability, showing one phase space trajectory**

Equations for 3D harmonic oscillator in spherical coordinates of our **3D quantum phase space display system** are in appendix, **ref. 1** on p. 82

This allows us to get generic boundary conditions for the quantum oscillator on  $N$  dimensional complex projective space ( $CPS$ ) and on its non-compact version i.e., Lobachewski space ( $LN$ ) in presence of constant magnetic field. As a result, we get a family of energy spectrums for the oscillator. Motion of a classical particle in 3-dimensional Lobachevsky and Riemann spaces is studied in the presence of an external magnetic field which is analogous to a constant uniform magnetic field in Euclidean space. In both cases three integrals of motions are constructed and equations of motion are solved exactly in the special cylindrical coordinates on the base of the method of separation of variables. In Lobachevsky space there exist trajectories of two types, **finite and infinite** in radial variable, while in Riemann space all motions are finite and periodical. The invariance of the uniform magnetic field in tensor description and gauge invariance of corresponding 4-potential description is demonstrated explicitly. The role of the symmetry is clarified in classification of all possible solutions, based on the geometric symmetry group,  $SO(3,1)$  and  $SO(4)$  respectively.

#### Elaboration

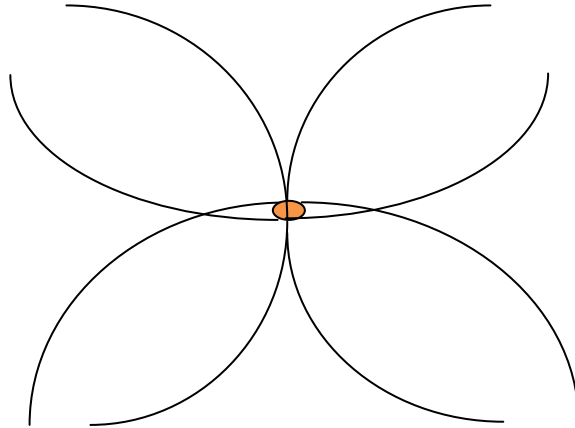
Our **quantum harmonics electronic system** will be based on a **quantum carrier (quantum ball or sphere)** and **jump-resonance phenomena** of nonlinear feedback control system. Second harmonic generation (see image below) with resonant enhancement is applicable to our quantum space display model discussed here.



**This cartoon depicts ordered molecules at a small spherical surface. An ultrafast pump laser pumps light with frequency  $\omega$  which generates light at  $2\omega$  from the locally non-centrosymmetric media.**

The nonlinearities are those whose outputs are single-valued odd functions of the inputs and are independent of frequencies of the photonic inputs. The general conditions under which **jump-resonance** occurs will be given and the system with saturation nonlinearity will be analyzed. The essential objective is to define **the contours on the complex plane** for the constant values of system variables, e.g., input amplitude, amplitude ratio, and phase shift.

Common **Frequency Hopping Spread Spectrum (FHSS)** will be upgraded by us in our quantum harmonics system to randomly propagate atomic particles by photonically switching from one signal carrier (quantum tube, see our **quantum harmonics**) to other quantum channels in thereby achieved dynamic equilibrium beyond chaotic interference. Fermi-Dirac distribution function and electrovacuum solutions of the Einstein-Maxwell field equations are applicable. Same concept can be applied in our remote **quantum loops space display system** (see the diagram in **fig. 1** below) to constitute space computers and TVs (see fig. 2). We accordingly introduce here the notions of a **spinning quantum spring** (fig. 2) to constitute a **spinning quantum ball or sphere** created by a multimodal quantum structure, fig. 1:



**Fig. 1.** This diagram shows the central **quantum nuclei** with quantum loops of **spinning quantum spring** that defines the horizon of the rotating plain constituting external quantum carrier – **quantum ball** -- a **3D plasma imagery space display** (fig. 2 below, fig 3 on p. 29 and fig. 4 on p. 30) in self-generated and contained e.m. field, as in a ball lighting (ref. 3 and 4), to be activated by a tunable pulse laser via spectral prism and acoustic membrane in a combination of colors and sounds in a remote **quantum space computer and TV**. (See **Rutherford's model** on p. 28 below and **G. Gamow: Quantum Theory of the Atomic Nucleus** (1928))



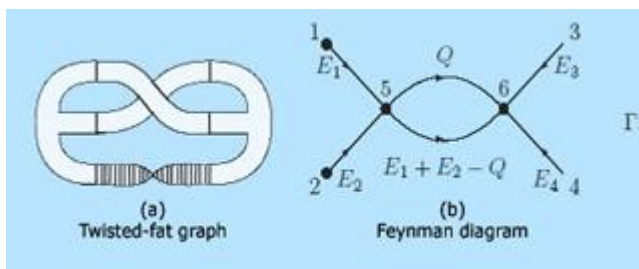
**Fig. 2.** Our **3D quantum space display concept for a quantum network in quantum spacetime** in [total angular momentum  \$\mathbf{J}\$](#) , which combines both the spin and orbital angular momentum of a particle or system:  $\mathbf{J} = \mathbf{L} + \mathbf{S}$ .

*In re:* Rudolf Peierls noted that electrons in a magnetic field can be regarded as moving in a quantum spacetime. See also Snyder, H. (1947), "[Quantized space-time](#)", *Phys. Rev. D*, 67: 38–41, [doi:10.1103/PhysRev.71.38](#)

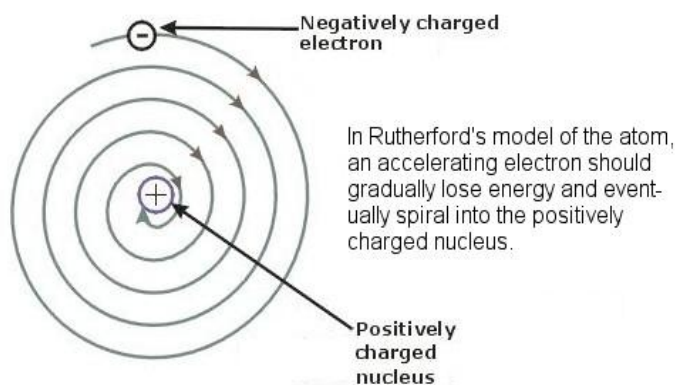
"Entangled particles behave as one, independent of distance. Any observation of such entangled electrons result in correlated information," Professor Ronald Hanson in Delft explains. Measuring one particle therefore instantaneously influences the other, even when they are light-years apart. Physicists at Australian National University have engineered a spiral laser beam and used it to create a whirlpool of hybrid light-matter particles called **polaritons**.

"Creating circulating currents of polaritons – vortices – and controlling them has been a long-standing challenge," said leader of the team, theoretician Dr Elena Ostrovskaya, from the Research School of Physics and Engineering, Australian National University "We can now create a circulating flow of these hybrid particles and sustain it for hours.

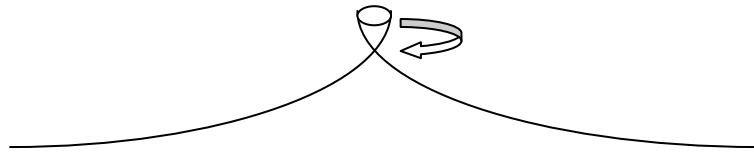
It appears that our **quantum ball particles' carrier** is a continuum of possible energies. When the carrier is confined to a 3D space, the quantum energy levels begin to spread out and the quantum nature becomes detectable, i.e., electrons will settle in the quantum ball and not in the adjacent layers. This carrier will then exhibit quantum effects imposed on it, where the number of particles trapped in the carrier can be controlled by an external voltage. Compare our multimodal quantum loops 3D diagram in **fig. 1 above, p. 27** with Feynman diagram of quantum field geometry and Rutherford's model of the atom below:



**Feynman diagram of quantum field geometry**



To visualize the spinning nature of our multimodal quantum system in fig 1 above, we show in **fig. 3** below a **central nuclei loop** of quantum spring with spinning “blades” that create the whirlpool of charged particles in **Coulomb force** as quantum ball’s overall structure.



**Fig. 3.**

Our **model of a spinning quantum spring** in fig 3 is the **core of a quantum ball** (or **plasmoid** as below) in **collective quantum plasma effects** when the quantum nature of its particles significantly affects its macroscopic properties in quantum-controlled fusion in **femtochemistry**, in which femtosecond-long laser flashes trigger chemical reactions. There, nuclei can be pushed close enough to overcome the **Coulomb barrier** that forces atoms of similar charge to repel each other, fuse and release heat through neutron scattering. When more energy is created than it takes to sustain the reaction, **sustained fusion** becomes viable.

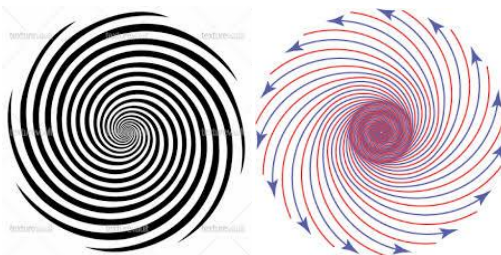
Our quantum device as a **quantum fusion generator, space computer/TV** is a spherically symmetric quantum plasmoid based on radial plasma oscillations. Such plasmoid can exist in dense plasma of electrons, ions, and neutral particles in virtual acoustic wave, which is excited in the neutral component of plasma. This interaction can be attractive and form ion pairs.



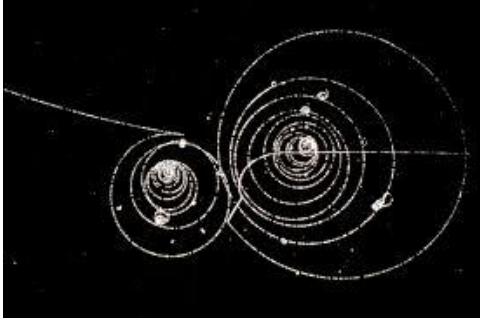
(Compare our ball with the ball lightning images in ref. 1, 2 below and fig.4 on p. 30 )



**Ref. 1. Ball lightning**



**Ref. 2. Spiral propagation of light**



**Fig. 4.** It shows a remote spinning quantum spiral in 3D space display per classical field theory with space-time manifold  $M$  (fig. 5 below) and field space  $F$ , where  $\phi : M \rightarrow F$ , and action critical points are  $S[\phi], dS = 0$ .



**Fig. 5.** Space-time manifold  $M$  as toroidal ring model, known originally as **plasmoid ring** with electrons and protons and was first proposed by Alfred Lauck Parson in 1915.

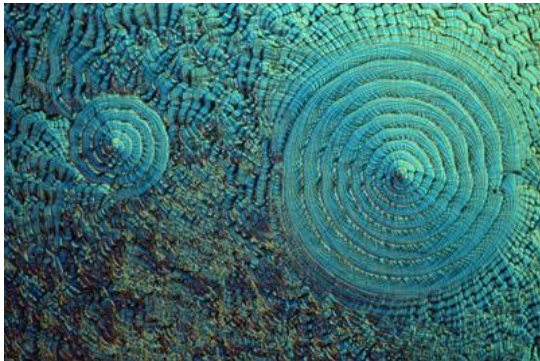
### Theory

Instead of a single orbiting charge, the **toroidal ring** was conceived as a collection of infinitesimal charge elements, which orbited or circulated along a common continuous path or "loop" as in our model in **fig 1, p. 27, and fig. 3, p. 29**. In general, this path of charge could assume any shape, but tended toward a circular form due to internal repulsive electromagnetic forces. In this configuration the charge elements circulated, but the ring as a whole did not radiate due to changes in electric or magnetic fields since it remained stationary. The ring produced an overall magnetic field ("spin") due to the current of the moving charge elements. These elements circulated around the ring at the speed of light  $c$ , but at frequency  $\nu = c/2\pi R$ , which depended inversely on the radius  $R$ . The ring's inertial energy increased when compressed, like a spring, and was also inversely proportional to its radius, and therefore proportional to its frequency  $\nu$ . The theory claimed that the proportionality constant was Planck's constant  $h$ , the conserved angular momentum of the ring.

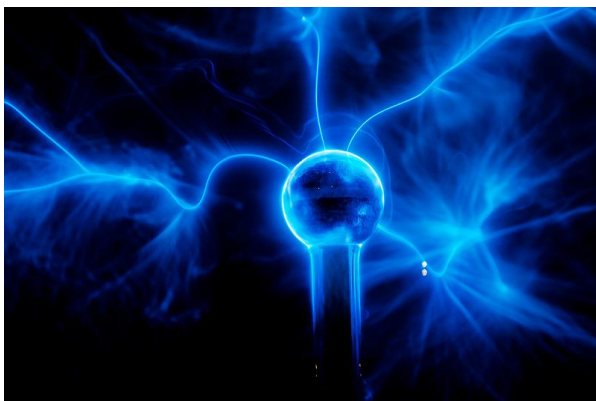
According to the model, electrons or protons could be viewed as bundles of "fibers" or "**plasmoids**" with total charge  $\pm e$ . The electrostatic repulsion force between charge elements of the same sign was balanced by the magnetic attraction force between the parallel currents in the fibers of a bundle, per Ampère's law. These fibers twisted around the torus of the ring as they progressed around its radius, forming a Slinky-like helix. Circuit completion demanded that each helical plasmoid fiber twisted around the ring an integer number of times as it proceeded around the ring. This requirement was thought to account for "quantum" values of angular momentum and radiation.

The toroidal or "helicon" model did not demand a constant radius or inertial energy for a particle. In general its shape, size, and motion adjusted according to the external electromagnetic fields from its environment. These adjustments or reactions to external field changes constituted the emission or absorption of radiation for the particle. The model, then, claimed to explain how particles linked together to form atoms.

For the nature of light and **quantum superpropagation** see p. 79



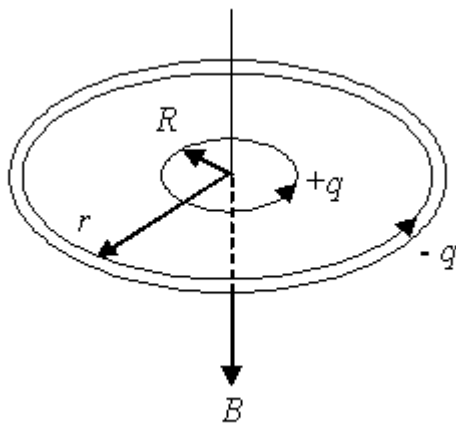
**Ref. 3. Compare this ball lightning structure with fig 2, p. 27, fig 4, p. 30 and ref. 4 below.**



**Ref. 4 Electron-ionic model of ball lightning** (from Wikiversity)

The **electron-ionic model of ball lightning** was presented by Sergey G. Fedosi , a physicist and the philosopher from Perm, Russia, and Sergey A. Kim, from Perm state university, in a number of works. Fedosin S.G., Kim A.S. [The Physical Theory of Ball Lightning](#). Applied Physics (Russian Journal) , No. 1, 2001, P. 69 – 87.

In their model, ball lightning is a cluster of the very hot ionized air with the positive charge in general, whose shell consists of the rapidly revolving electrons with the total current up to  $1,4 \cdot 10^5$  A. Ball lightning as whole is supported by the balance of the electromagnetic forces, which act between the charges. Positive ions inside the lightning are distributed freely as a result of the spherical symmetry, and attract to themselves the electrons of shell, retaining them from the dispersion. According to the model the ball lightning is formed from two close branches of a linear lightning at the time of termination of current in the main channel with the subsequent closure of branches in a current ring.



Equatorial cross-section model of ball lightning as a distinct ring on the current sheet spheroidal shape.  $R$  - radius of rotation of ions in the equilibrium shell around the magnetic field with induction  $B$ ,  $r$  - radius of the outer electron shell.

Electronic currents in the shell create strong magnetic field inside the lightning. These currents are perpendicular to rotational axis, the diameter of rotation decreases to the poles, where magnetic field grows. This retains positive ions from the dispersion along the rotational axis due to the effect of magnetic bottle. Basic magnetic field inside the lightning is directed along the rotational axis. I.e., ions can move along the axis along the lines of magnetic field. From other side, the ions revolve in the circle perpendicularly to axis under the action of Lorentz force with respect to their thermal velocity. As a result at a certain distance from the axis of lightning appears the intersection of two ion flows, which is observed as the luminous shells inside the lightning. Emission from the shells appears from friction and recombination of the being intersected ion flows.

Theory predicts from the first principles the maximum diameter of ball lightning 34 cm. With the larger size the summary charge of lightning, which has positive sign, grows to the value of  $10^{-5}$  C and appears the electrical breakdown of air near the lightning. The energy of the lightning in this case reaches 10.6 kJ, the current in the shell  $1,4 \cdot 10^5$  A, the internal magnetic field of 0.5 Tesla.



Because of its charge ball lightning does not simply float under the action of the force of Archimedes, but it is retained by electric force from clouds and the induced charge on the Earth. The formula for the maximum radius of ball lightning has the form:

$$r = \frac{mc^2}{qE_0},$$

**Ref. 4:**

**Derivation of the Fermi-Dirac distribution function**

We start from a series of possible energies, labeled  $E_i$ . At each energy we can have  $g_i$  possible states and the number of states that are occupied equals  $g_i f_i$ , where  $f_i$  is the probability of occupying a state at energy  $E_i$ .

The number of possible ways - called configurations - to fit  $g_i f_i$  electrons in  $g_i$  states, given the restriction that only one electron can occupy each state, equals:

$$W_i = \frac{g_i!}{(g_i - g_i f_i)! g_i f_i!}$$

This equation is obtained by numbering the individual states and exchanging the states rather than the electrons. This yields a total number of  $g_i!$  possible configurations. However since the empty states are all identical, we need to divide by the number of permutations between the empty states, as all permutations can not be distinguished and can therefore only be counted once. In addition, all the filled states are indistinguishable from each other, so we need to divide also by all permutations between the filled states, namely  $g_i f_i!$ .

The number of possible ways to fit the electrons in the number of available states is called the multiplicity function.

The multiplicity function for the whole system is the product of the multiplicity functions for each energy  $E_i$

$$W = \prod_i W_i = \prod_i \frac{g_i!}{(g_i - g_i f_i)! g_i f_i!}$$

Using Stirling's approximation, one can eliminate the factorial signs, yielding:

$$\ln W = \sum_i \ln W_i = \sum_i [g_i \ln g_i - g_i(1 - f_i) \ln(g_i - g_i f_i) - g_i f_i \ln g_i f_i]$$

The total number of electrons in the system equals  $N$  and the total energy of those  $N$  electrons equals  $E$ . These system parameters are related to the number of states at each energy,  $g_i$ , and the probability of occupancy of each state,  $f_i$ , by:

$$N = \sum_i g_i f_i$$

and

$$U = \sum_i E_i g_i f_i$$

According to the basic assumption of statistical thermodynamics, all possible configurations are equally probable. The multiplicity function provides the number of configurations for a specific set of occupancy probabilities,  $f_i$ . The multiplicity function sharply peaks at the thermal equilibrium distribution. The occupancy probability in thermal equilibrium is therefore obtained by finding the maximum of the multiplicity function,  $W$ , while keeping the total energy and the number of electrons constant.

For convenience, we maximize the logarithm of the multiplicity function instead of the multiplicity function itself. According to the Lagrange method of undetermined multipliers, we must maximize the following function:

$$\ln W - a \sum_j g_j f_j - b \sum_j E_j g_j f_j$$

where  $a$  and  $b$  need to be determined. The maximum multiplicity function is obtained from:

$$\frac{\partial}{\partial (g_i f_i)} \left[ \ln W - a \sum_j g_j f_j - b \sum_j E_j g_j f_j \right] = 0$$

which can be solved, yielding:

$$\ln \frac{g_i - g_i f_i}{g_i f_i} - a - b E_i = 0$$

or

$$f_i = f_{FD}(E_i) = \frac{1}{1 + \exp(a + b E_i)}$$

which can be written in the following form

$$f_{FD}(E_i) = \frac{1}{1 + \exp\left(\frac{E_i - E_F}{\beta}\right)}$$

with  $\beta = 1/b$  and  $E_F = -a/b$ . The symbol  $E_F$  was chosen since this constant has units of energy and will be the constant associated with this probability distribution.

Taking the derivative of the total energy, one obtains:

$$dU = \sum_i E_i d(g_i f_i) + \sum_i g_i f_i dE_i$$

Using the Lagrange equation, this can be rewritten as:

$$dU = \beta d(\ln W) + \sum_i g_i f_i dE_i + E_F dN$$

Any variation of the energies,  $E_i$ , can only be caused by a change in volume, so that the middle term can be linked to a volume variation  $dV$ .

$$dU = \beta d(\ln W) + \left[ \sum_i g_i f_i \frac{dE_i}{dV} \right] dV + E_F dN$$

Comparing this to the thermodynamic identity:

$$dU = TdS - pdV + \mu dN$$

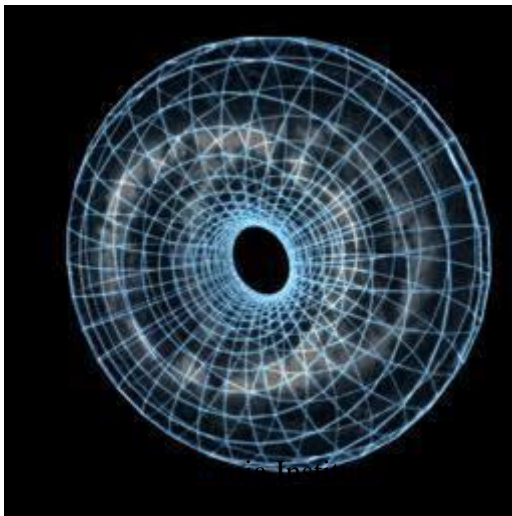
The energy,  $E_F$ , equals the energy associated with the particles,  $\mu$ .

The comparison also identifies the entropy,  $S$ , as being the logarithm of the multiplicity function,  $W$ , multiplied with Boltzmann's constant. The Fermi-Dirac distribution function then becomes:

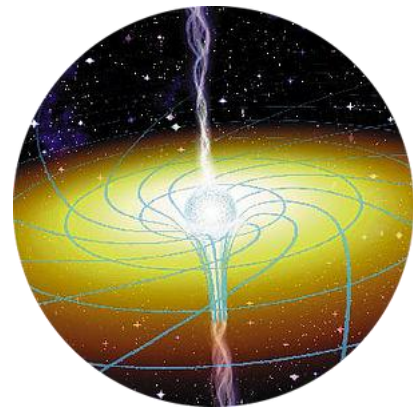
$$f_{FD}(E) = \frac{1}{1 + \exp\left(\frac{E - E_F}{kT}\right)}$$

©. B. Van Zeghbroeck, 1998

It portrays space and time as conformal projections of motion, and reveals the correlation between the universality of space-time (relativistic model) and energy-frequency (quantum model). This new theory of astrophysics proves that **unified matter of coupled superstrings** created a **supercavity** previously thought to be a black hole, thus negating the assumption of a gravitational collapse of a star to form a black hole. In general, there is no cosmic hole in the fabric of space where the **macroscale density of space** and not the microscale density of matter should be considered. What was previously conceived as a black hole is a **self-gravitating torus** (see ill. below) – a **cosmic supercollider of doubly elliptic strings manifold**, and this explains the origin of relativistic jets from magnetized accretion disks, as elaborated below.



**Clifford torus**



**Hydrodynamic simulation of rotating black hole**  
(by quantum gravity lab, Nottingham univ.)  
confirms our **torus model** of the black hole

Accordingly, this chapter contributes to the understanding of the formation of **twin self-gravitating accretion discs** by **twin superstrings** in gauge/gravity duality, where at  $D = 26$  the string dynamics is that of harmonic oscillators, as was predicted earlier by duality theorists. Hence, our new cosmic model is in conformity with the basic principle of duality in nature, where no singular event of the alleged Big Bang could had taken place, for there must always be the cause and the effect in a dual interaction, as in the wave-particle duality.

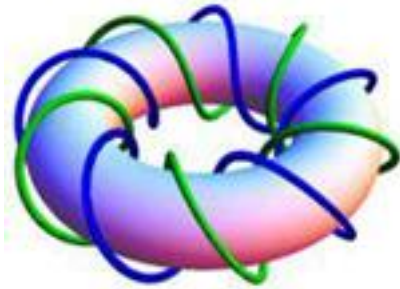
#### Theory of Quantum Gravity

Two parallel lines never meet in geometry, but superstrings of matter in cosmos might couple and converge in a bow-like superstructure with a shock wave, as in **fig. 4** on p. 36 and **ref. 2** on p.39. Compare, on earth a pair of lines of longitude is parallel at the equator but converge toward the poles. So, let's consider two parallel superstrings of matter with integrated accretion discs in the middle of each one. (Fig. 1 on p. 33)

Those discs are formed by two **coupled linear superstrings** of matter, whose shared central core inflates to create an accretion disc (fig. 1) in a quasi super-Planckian effect (fig 2.)



**Fig. 1. Coupled superstrings**



**Fig. 2. Accretion disc of coupled superstrings**

The accretion disc of matter in fig. 1 and 2 consists of **nuclei** (see ref. 3 on p. 40) and membrane that oscillate in unison in **unified resonant frequency** in a given frame of space-time, which is not trapped in geometrical dimensions, but oscillates/modulates in different atomic frequencies we cannot perceive or detect, for we're not yet tuned to them, as a common radio cannot pick up radio waves it is not tuned to. Therefore, our superstrings model and concept differ from the string theory model, which envisages a structure of different integrated, not unified and inharmonic shapes, which cannot co-vibrate in common pitch. (For **pitch** see ref. 3)

In our opinion, a cosmic superstring resembles a hexagonal musical string which has a "core" of one material, and is encircled by other material. A musical string is linearly stretched along the fingerboard of a musical instrument, where the fingers of the musician press/short them in different intervals, while the bow pulls the string sideways to make it vibrate in various sounds. Similarly in cosmos, a superstring of matter stretches itself linearly in space where applied gravity presses/shorts it in spacetime intervals/knots of matter and then pulls it sideways to make it resonate/oscillate in various frequencies and gravitational waves that create a supercavitation (not a black hole) in space caused by the density of coupled superstrings, as in fig. 1.

Accordingly, our superstring is not a macrojet of matter but a chain of intertwined gauge/gravity microstrings -- cosmic tubes that funnel the invisible superfluid dark matter (as **continuum fluid in the phase space**) and highly compressed energy in thereby twisted spacetime (Fig. 3 a, b), which **expands and contracts** in pulsation due to inherent gravity and fluorescent mirror reflections of subatomic particles.



**Fig. 3, (a, b)**

**These are chains of microstrings in twisted timespace** as time and space woven together per Einstein's theory of relativity. Our concept image of intertwined/woven superstring fabric in fig. 3 has its further confirmation in **ref. 4** on p. 41.

So in our unified model, coupled superstrings unify in space via supercore (fig. 1 above) of the overlapping, oscillating condensed matter (fig. 2 above), which creates in supercavitation a superdensity vortex, previously termed the black hole that had puzzled scientists who couldn't comprehend how matter spiralling around a black hole in an **accretion disk** suddenly plunges into the void without gravitational collapse.

*Nota bene:* the intertwined superstrings in fig. 3 above have open opposite ends through which matter traverses spacetime in superconductivity contrary to the speed of light constant, for said superstrings acts as a supercollider and superaccelerator in space. The inherent shape of our superstrings with integrated succession of multiple micro-barriers in supercold **vacuum chambers** explain the phenomena of neutrinos that propagate unobstructed through space and earth, originate in one part of the universe and immediately appear in a remote part by piercing spacetime. For **neutrinos** the **spin** is always **opposite** the linear momentum, so in our superstring accelerator we might deal with the **Casimir effect** and particles that emit the virtual photons which lose momentum **p** in the recoil, and the other particles get the momentum.

Vacuum neutrino oscillations are possible in relativistic wave packets per quantum field theory. Neutrino is considered as wave packets either in QM or in QFT. QM postulates the wave function of neutrino and this is the source of numerous paradoxes. Standard S-matrix theory of QFT works with states of definite momentum -- neutrinos uniformly distributed over all space in the propagation momentum in **phase optimization** per Wave Field Theory.

The neutrino state is a superposition of massive **neutrino** wave packets determined by the production process where the energies and momenta of the massive neutrino components relevant for neutrino oscillations are in general different from the average energies and momenta of the propagating massive neutrino wave packets, as in our model of the **cosmic neutrinos accelerator**.

(See C. Giunti, Neutrino Wave Packets in Quantum Field Theory, 2002. D. V. Naumov and V. A. Naumov, Vacuum neutrino oscillations with relativistic wave packets in quantum field theory. J. Phys. G 37 (2010) 105014, Dmitry V. Naumov, 2011).

In re: Physicists may have linked the elusive source for the **highest energy neutrinos**, abundant sub-atomic particles with no electrical charge that race through the universe to a supermassive cluster of matter at the center of the Milky Way galaxy called Sagittarius A\*. Observations leading to a potential breakthrough in the identification of a source were made with three NASA space telescopes, the 15-year-old Chandra X-ray Observatory, 10-year-old Swift Gamma Ray Burst mission observatory and the 2-year-old NuSTAR (an X-ray observatory), as well as the IceCube Neutrino Observatory, which is positioned under the South Pole. IceCube has recorded 36 high-energy neutrinos since the facility became operational in 2010. "We now have the first evidence that an astronomical source, the Milky Way's supermassive black hole may be producing these very energetic neutrinos," states University of Wisconsin physicist Yang Bai, in a Nov. 13 NASA announcement. He is among a half dozen scientists from the universities of Wisconsin and Hawaii who published their findings in Physical Review D.

The idea is that albeit a neutrino has no single mass, by passing through each termonuclear combustion chamber in our superstring, a swarm/block of neutrinos accelerates in jets (see ref. 3) with each fusion cycle and accumulates enormous cumulative energy to warp the spacetime where the entry point is the instant exit point for neutrinos in any part of the universe. Hence, the protouniverse might have been built by such blocks of primordial matter to then evolve into our universe per my **theory of dual (non-parallel) universes**.

We can accordingly claim that **condensed water** is the end product of fusion in cosmic accelerator described above, i.e., when the positron passes through a cloud chamber it simply doesn't have enough time around any particular electron. What it does do, however, is to ionize some of the atoms which, in turn, allows the super saturated water vapour to condense along the path in our twin superstrings -- twin black holes integrated system as in fig. 4 on p. 36.

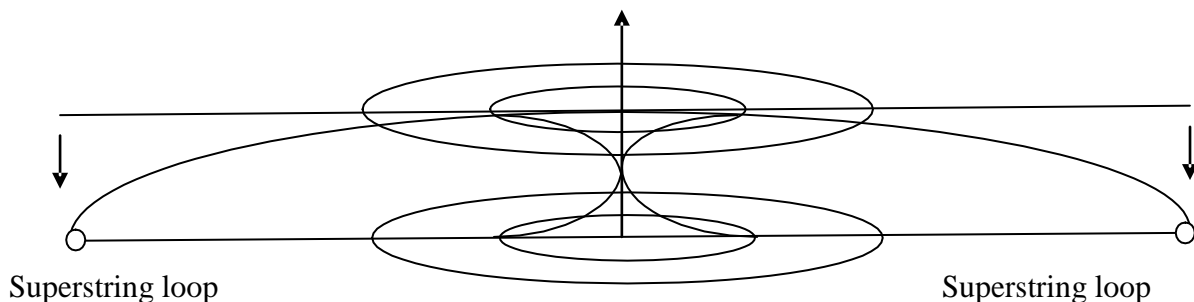
With regard to the **unified matter model** in fig. 4 below, **local quantum entropy** there had reached its saturation point beyond **Von Neumann entropy and Lev Landau\* state vector** limits, so the ends of the upper linear string of matter in our model were curved and gravitationally pulled/shifted (for **shift** see ref. 3) downward to the corresponding ends of the linear base string of matter, creating thereby a **bow of unified matter** (fig. 4 and ref. 2 below) with the jet arrow of matter emitted along the axis of rotation from the base disc via upper disc over its event horizon, as shown in fig. 4. So in our bow of matter model we deal with the induced curvature of space per theory of general relativity, which predicted that a sufficiently compact mass can deform the space-time. \*Landau, L. (1927). "Das Daempfungproblem in der Wellenmechanik". *Zeitschrift für Physik*. 45 (5–6): 430–464

Large vertical **arrow** in our model represents a relativistic jet of matter which erupts from the twin superstrings structure due to accumulated tension applied by the **bow of unified matter** and rotational acceleration around the axis of the disc core. The 2009 experiments conducted by Professor Sergey Lebedev's team in the Department of Physics at Imperial College London ([www.imperial.ac.uk](http://www.imperial.ac.uk)) confirm our theory and model by suggesting that the jets of matter are fired out more like bullets or buckshot: they don't break into pieces -- they are formed "in pieces."

And that in our opinion could be the **anti-gravitational fall up of anti-matter**.

Note that our jet-arrow of matter points in one upward direction and isn't emitted in the opposite direction as suggested by the astronomers in ref. 3 on p. 40. In fact, the info in ref. 3 confirms our twin accretion disks concept as shown in **fig. 4** below, where the jet of matter from **invisible lower disc of dark matter** is emitted via upper visible twin disc, in accordance with the **constant of duality** in the nature and cosmos. (Compare with twin galaxies or single ones after separation).

The shown in fig 4 **bow of matter model** has its reflection in a bow-like shock wave in cosmos in NASA image (see photo in ref. 3 on p. 40).



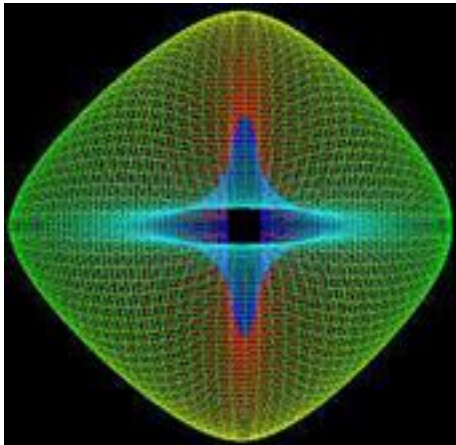
**Fig. 4. Bow of Matter Model**



Twin parallel superstrings with twin accretion discs in our bow of matter model above are created by **doubly elliptic strings** (fig. 5 below) and function as **toroidal “saddle” space** (fig. 6) and **dynamic horn tori** with a uniform grid (fig. 7 on p. 38), where matter from the upper accretion disk in our model is forced downward to the lower accretion disk by **Coriolis force**, to then erupt upward in a jet of matter via upper disk due to accumulated density, energy and pressure.

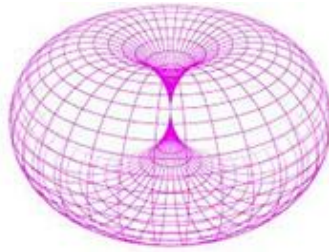


**Fig. 5. Doubly elliptic strings**



**Fig. 6. Toroidal saddle space, integrating self-gravitating torus** previously mistaken for a black hole.

Our model of matter above fits the geometry of the universe which is "open" or negatively curved like a **saddle**, according to a new model proposed by researchers in Europe who have studied anomalies in the cosmic microwave background radiation. The anomalies were first detected by NASA's Wilkinson Microwave Anisotropy Probe (WMAP) in 2004 and were confirmed earlier this year by the European Space Agency's Planck space mission.



**Fig. 7. Dynamic horn torus**

We further elaborate that toroidal shape of matter has no central "hole" and is not a "black hole" per se, since it folds in upon itself (general relativity) and all points along its surface converge into a zero-dimensional point at the center called the vertex, which acts as a particles trap where particles collide and interact.

One might ask how the gravitational pull and the bow o matter was created in the parallel superstrings of matter in our model (fig. 4, p. 40 above), with no external force applied. The answer is that we deal here with the warps of matter as the set of lengthwise streams of particles (fig.3, p.38 above) held in opposing tension in said strings and twisting around those strings of matter. **Quantum electrodynamics in quantum superposition** is applied here, for two parallel strings of matter attract or repel themselves depending on whether the energy flows in the same or opposite directions in mutual action, where two lengths of matter-carrying strings is proportional to their lengths and to the intensities of their currents, to paraphrase the **Ampere's law**.

Our warp concept is supported by a practical experiment conducted by Professor Sergey Lebedev's team in the Department of Physics at Imperial College London that sent a high-powered pulse of energy into an aluminium disk. In less than a few billions of a second, the aluminium began to evaporate, creating a cloud of plasma very similar to the plasma cloud surrounding a young star. Where the energy flowed into the center of the disk, the aluminium eroded completely, creating a hole through which a magnetic field from beneath the disk could penetrate. The field initially pushes aside the plasma, forming a bubble within it. As the field penetrates further and the bubble grows, however, the magnetic fields begin to **warp and twist, creating a knot in the jet**.

To discuss further our superstrings of matter, we come to the notion of **repellent gravity**, as observed in galaxies. Due to anti-gravity between two superstrings of matter in our model, matter shifts toward the density points/loops at the ends of unified strings. (For **shifting** see ref. 3 below). This corresponds with Max Planck's idea of a harmonic oscillator (classically, anything that wiggles like a mass bobbing on the end of an ideal spring). Hence, our superstrings are **plugged** at their low density vertex, representing a **plasma conductor in a vacuum loop** that can withstand large gravitational pull. Dynamics of plasma are often the sources of electromagnetic fields. ((Loop quantum gravity and **Aharonov–Bohm effect** might be applicable). Our superstrings model corresponds also with the **superfluid vacuum theory (SVT)**.

Moreover, our bow-like superstrings model in fig 4, p.36 provides the “ quantum bridge” between contracting and expanding matter where the fragmentation of the horizon by superimposed superstrings creates loops that accrete and bind in collapsing matter perturbations, since the string tension is less than a critical value and the loops are large-scale.

**Ref. 1**

**Twin Black Holes**

**Discovered** Posted

October 3rd, 2012

Astronomers recently made a surprising find while searching for a unique black hole in a tight cluster of stars 10,000 light years away from Earth. Instead of finding one black hole, scientists with the National Radio Astronomy Observatory (NRAO) found two twins, something that surprised them because, according to modern theory, there should only be one black hole in a cluster.

**Ref: 2**

**Supernova-powered bow shock creates cosmic spectacle**

12:31 21 January 2013

Picture (below) of the DaySpace. *Victoria Jaggard, space and physical sciences news editor*



*(Image: NASA/JPL-Caltech)*

### **Ref. 3**

2013: Using the European Space Agency's (ESA) XMM-Newton observatory, lead author Dr. María Díaz Trigo and colleagues studied a black hole binary system located in our own galaxy. This system, called 4U1630–47, has been known to show X-ray outbursts over the period of several months or even years, the agency explained in a statement.

“In our observations, we found signs of highly ionized nuclei of two heavy elements, iron and nickel, said Trigo, who works at the European Southern Observatory in Munich, Germany. The discovery came as a surprise – and a good one, since it shows beyond doubt that the composition of black hole jets is much richer than just electrons.”

“Intriguingly, we found the lines were not where they should be, but rather were shifted significantly said Dr. James Miller-Jones, who led the radio observations and is a member of the International Centre for Radio Astronomy Research (ICRAR). That shift was similar to that of the pitch change of a vehicle’s siren as it moves towards or away from the hearer, and signified that the length of the sound wave is becoming shorter or longer due to the movement. The phenomenon led the study authors to believe that the particles were being accelerated to high speeds while in the jets – one towards the Earth, and the other in the opposite direction. According to Dr. Miller-Jones, this is the first strong evidence of the presence of such particles in typical black hole jets. –We’ve known for a long time that jets contain electrons, but haven’t got an overall negative charge, so there must be something positively charged in them too, he explained.”

“Until now it wasn’t clear whether the positive charge came from positrons, the antimatter “opposite” of electrons, or positively charged atoms, the Dr. Miller-Jones added. –Since our results found nickel and iron in these jets, we now know ordinary matter must be providing the positive charge.”

Read more at <http://www.redorbit.com/news/space/1113003040/black-hole-jet-contents-111413/#i7XX4sDVdvHdPqrQ.99>

#### **Ref. 4**

#### **Monster black hole from early cosmos challenges physics.**

Thursday, 26 February 2015 Genelle Weule and Stuart Gary, ABC, see picture below.



“New physics are needed to explain an ancient supermassive black hole quasar 12 billion times the mass of the Sun (NASA/Caltech). **The discovery of a supermassive black hole from the early cosmos is set to rewrite physics, say scientists**”.

An international team of astronomers detected a black hole 12 billion times the mass of our Sun, they reported in the journal Nature. The black hole is the source of a powerful beam of bright material known as a quasar.

"When we found this supermassive black hole we got very excited because we had found something that we never thought we could find," says Dr Fuyan Bian of the Australian National University.

The team, led by Xue-Bing Wu at Peking University, discovered the black hole and quasar -- known as SDSS J0100+2802 -- using the Sloan Digital Sky Survey, then followed up with three other telescopes. With a luminosity of 420 trillion that of our Sun's, the new quasar is seven times brighter than the most distant quasar known. "This quasar is very unique. Just like the brightest lighthouse in the distant universe, its glowing light will help us probe more about the early Universe," says Wu.

**(NEW MODEL OF SPACE-TIME)**

**Matter and spacetime**

This is a theory that makes macroscopic predictions based on the principle of duality as universal constant in space-time continuum, which is *finite in its infinity* due to integrated horizon and inherent reverse polarity. It implies that there is an absolute frame of reference in our **uniform double cone space-time model** (as observed in cosmos) which shows that the state of our universe is a deterministic function of its previous state of a primordial universe where the rotating mass of first order extended in our universe to second order in the angular momentum.

Locality assumes that the current state of space-time is determined by the states of a fixed number of previous time steps. Discretized difference equations use at least the current and previous time steps if they are second order systems like the wave equation. **Physical quantities come in pairs** which are called *conjugate quantities*. According to quantum mechanics, under some conditions, **a pair of quantum systems may be described by a single wave function**, which encodes the probabilities of the outcomes of experiments that may be performed on the two systems, whether jointly or individually.

It means that the actual space-time is not flat per Einstein-Minkowski space-time formed on 2D Lorentzian geometry, and that there couldn't be a singular event of a Big Bang due to a single, primitive force ("primeval atom") that allegedly caused a sudden "birth" of space-time without a preceding event in the past, i.e., "conception" of our universe in primordial universe, constituting thereby a **double cone universal structure**. Accordingly, our 4D space-time model comprises a cross-like structure with the integrated spiral timeframe dimension that enables no analogy spacecrafts to traverse space-time unimpeded, as described in this article.

And it is obvious now that the commonly assumed cosmic model didn't actually integrate time, for it wasn't a space-time model per se, but a limited comprehension of the space-matter-energy correlation with wrongly perceived light-gravity-time interaction: there can't be gravitational bending of light and time delay in non-visible cosmic spectrum (which is 95% of our universe) and in the anti-gravity field of the galaxies.

So the observed effects of quasi gravitational lensing of *Einstein ring* (**in fact diffraction of light per** position-momentum uncertainty principle) and the *Shapiro delay* should be rightfully attributed to the Faraday rotation and relative phase shift in the interstellar medium, the **Coanda effect** and shift, and the superposition, dispersion and deflection (echo) of the manmade radar beams radiated in the multi-radiated cosmos.

Moreover, light is an inhomogeneous wave (not uniform) and cannot be bent as such by the gravity. Light can indeed deviate from its rectilinear path due to "ray-optics" limit (geometrical optics) and due to nonlinear **self-oscillation** and **chaotic interference** of the particles in analogy with the free-electron-laser chaos; under such conditions the time delay can actually take place.

So the shape of the universe is a matter of debate in physical cosmology over the local and global geometry of the universe which considers both curvature and topology, though, strictly speaking, it goes beyond both. The Big Bang theorists have overlooked the **Coriolis**, **Doppler** and **Chladni effects** in the universe, as revealed in this article to proper explain the rotation and expansion of our universe.

So we present here a new space-time model with a 4-dimensional **double cone structure** of our universe (successor of primordial universe), confirmed by natural phenomena (elaborated below) which negates the Big Bang theory.

*In re:* the  **$\Lambda$ CDM** or **Lambda-CDM** model is a parameterization of the Big Bang cosmological model in which the universe contains a cosmological constant (usually denoted by the Greek capital letter lambda:  $\Lambda$ ), which is supposed to be equivalent to the energy density in otherwise empty space. It was proposed by Albert Einstein as a modification of his original theory of general relativity to achieve a stationary universe. Einstein abandoned that concept since Hubble redshift indicated that the universe might not be stationary, contrary to Einstein's idea that the universe is unchanging.

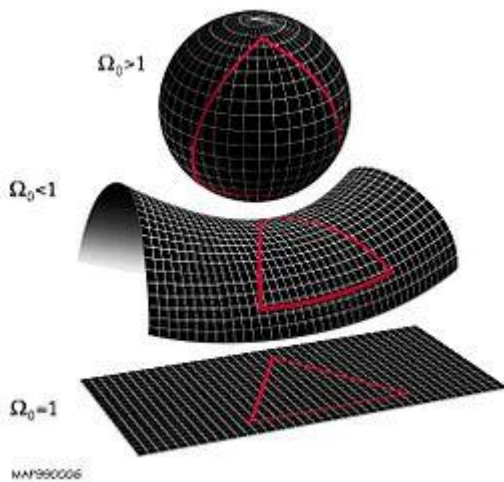


Fig.1

Shown in fig.1 is the common local geometry of the universe which is determined by whether the density parameter  $\Omega$  is greater than, less than, or equal to 1. From top to bottom: a spherical universe with  $\Omega > 1$ , a hyperbolic universe with  $\Omega < 1$ , and a flat universe with  $\Omega = 1$ .



Scientists reached a consensus that there was more to the universe than meets the eye. In computer simulations of our galaxy, the Milky Way, theorists found that the center would not hold. Based on what we can see of it, our galaxy doesn't have enough mass to keep everything in place. As it rotates, it should disintegrate, shedding stars and gas in every direction.

So to advance our knowledge, a detailed study of the cosmic space has been made and elaborated in this article from a different perspective to supersede the Big Bang and Steady State concepts and modify the special theory of relativity based on new notions and discoveries in an attempt to unify Einstein's theory of relativity and the revolution of quantum mechanics.

Accordingly, we present here a new space-time model – a tandem of primordial and current universes coupled at their narrowest double cone point. Said tandem universes represent the duality of nature, as is the space-time notion and the wave–particle duality of matter.

As the distance between galaxy clusters is increasing, it is inferred that everything was closer together in the past, since galaxies and clusters have an apparent velocity directly away from our vantage point.

There was previously little evidence regarding the absolute earliest instant of the expansion. That concerns also the Big Bang (BB) concept which cannot and does not provide sufficient explanation for such an initial condition. Rather, it tries to describe the supposed evolution of the universe from that point on. The Big Bang idea and model is based on the observation that galaxies seem to move away from the earth, and that radiation comes from the point where the Big Bang supposedly occurred as the alleged creation of our universe.

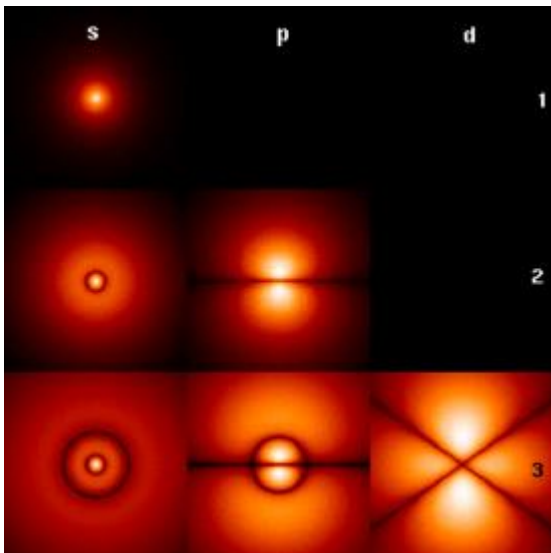
The BB theory doesn't explain how the pieces of matter that had never been in contact with each other have come to equilibrium at the very same temperature and then experienced an incredible burst of expansion called "inflation." For that inflation to have taken place, the universe at the time of the Big Bang must have been filled with an unstable form of energy whose nature is not yet known and which had allegedly led to the clumping and *ignition of matter, with no explosion*.

This is a wrong celestial theory, for there couldn't be a **dimensionless propagation constant** and equal mass distribution of matter forced to spread by the alleged quantum noise (?!).

The Big Bang is believed to have produced equal amounts of matter and antimatter. However, whenever matter and antimatter meet, they annihilate in a burst of gamma rays, so the BB theory suggests that both matter and antimatter annihilated long time ago, and the universe should consist today just of radiation.

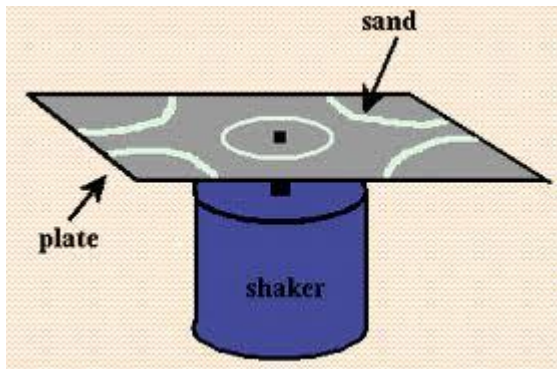
Said erroneous assumptions can be disproved, for there were no volume dimensions or directions in the void (empty cosmic space), since it had no boundaries, and if it had had, the shock wave of the BB would have bounced back, dispersed and destroyed the cosmic matter.

Accordingly, what the San Diego astronomers considered in 2005 to be the **vestiges of sound waves** that allegedly rumbled through the universe after the Big Bang, was in fact the echo of matter waves, and this corresponds with my **new theory of acoustics** (see my book “The Absolute Tone”) where sound waves have actually not linear but spiral form of propagation, and that could be the only form of propagation in space. That space shockwave must have spread the matter and gave its spiral shape to the formation of galaxies, for a spiral is the best shape to conserve energy and resonate its elements. So we might less consider the annihilation and decay of elementary particles, but concentrate more on their **resonance** in space-time in a Chladni-like effect based on quantum mechanics of the dual *particle-like* and *wave-like* behavior and interactions of **energy** and **matter**, as in **Förster resonance energy transfer** (ill. 1).



(III. 1. Probability densities corresponding to the wave functions of an electron in a hydrogen atom possessing definite energy levels (increasing from the top of the image to the bottom:  $n = 1, 2, 3, \dots$ ) and angular momenta (increasing across from left to right:  $s, p, d, \dots$ ). Brighter areas correspond to higher probability density in a position measurement. Wave functions like these are directly comparable to Chladni's figures of acoustic modes of vibration in classical physics, and are indeed modes of oscillation as well, possessing a sharp energy and, thus, a definite frequency. The angular momentum and energy are quantized, and take only discrete values (as is also the case with resonant frequencies in acoustics, ill. 2, 3 below)

Compare the ill. 1 above images with the Chladni plate acoustic effects (ill. 2, 3):

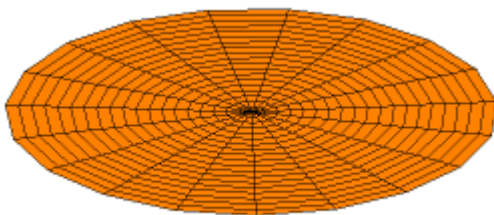


(Ill. 2,



3)

Having that in mind, we can construct a disc-like spacecraft with a Chladni plate effect, ill 4, below, where the atomic reactor in the center of the rotating disc would generate charged particles resonating in a modulating unison of specific frequencies amplified by the applied magnetic field and accelerated in circular grooves of particles accelerator on the surface of the disc-craft, leaving behind a whirlpool of matter and propelling the craft in space like a Frisbee. (*Patent rights for this spacecraft's design and propulsion belong to the author, Solomon Budnik*)



**III 4.** Chladni effect: vibration of a single normal mode of a circular disc with a pinned boundary condition along the entire outer edge)

In re: **Effects of tune modulation on particles trapped in 1D resonance islands,**

FERMILAB October 1993: experimental data obtained at Indiana University Cyclotron Facility for the 4th order resonance islands has confirmed this characteristic feature. The beam, driven by betatron tune modulation, was observed for the first time to travel from near the center of resonance islands toward the separatrix. The experimental data are characterized by the onset of large response at a critical modulation amplitude and frequency, which are compared with theoretical models.

## Matter and the Universe

Galaxies and clusters have an apparent velocity directly away from our vantage point, but directly toward the other vantage point at a distant planet, if inhabitant.

So the pertinent question here is: how the expansion of the observable universe began with the explosion of a single particle at a definite point in time if all the matter in the universe was packed together in an extremely dense state per Big Bang theory of Georges Lemaître, previously thought of by Alexander Friedman?

What was the force that propelled primordial matter to that tiny spec in the open space, and how that space could be without a previous universe, what magnetic field, gravitational force and pull could attract matter? That universal force had to be supercharged to attract large amounts of matter from all directions, and that would be impossible if primordial matter would had consisted just of a small quantity of weak subatomic particles of short range propagation. That baby matter couldn't be attracted by primordial nuclei due to the absence of sufficient pull, and it would also be impossible in the absence of primordial gravitational force prior to Creation.

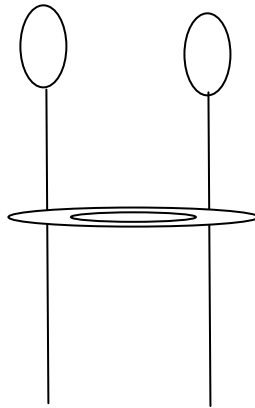
The Big Bang idea discredits itself, for if all the matter was at one place without induced pressure and heat, it would had led to the disintegration of low energy particles in a *spontaneous broken symmetry* when a system possessing a certain symmetric property collapses into a vacuum state (lowest possible energy) that does not possess symmetric property. That would have been a *metabolic energy collapse* (in terms of biology), meaning that a high energy demand to supposedly make a big bang, would had lead to the metabolic collapse of matter as a creating organism.

It means that our universe is not homogeneous, for it is comprised only of 4.9% of the ordinary matter, with the rest consisting of dark matter and dark energy. So far, no one had properly explained the birth of the universe, how matter was created in the void prior to the BB. But every natural birth requires two attracting forces of opposite charge. Same concerns the creation of primordial universe in its successive stages of Creation in space where **LQG (loop quantum gravity)** predicts that not just matter, but also space itself, has an atomic structure.

So let's envision the dual protomatter in space as "Adam" and "Eve" (A&E in fig 2, p. 49) – two icy-material **loops**, consisting of a few light nuclei along with free protons and electrons that produced non-zero magnetic field. The entropy of primordial universe was very small, but its small temperature, as in **de Sitter empty phase**, allowed for fluctuations into a proto-inflationary configurations: A&E loops started to melt due to **internal magnetic fluctuations** and produced two uniformly suspended **vertical threads of matter** of opposite charge, repelled in anti-gravity (antimatter repels matter with the same magnitude as matter attracts matter) and encircled at their middle sections by magnetic field. (Creation, stage 1, fig.2, **zero curvature**).

## Adam & Eve (A&E)

**Fig. 2**

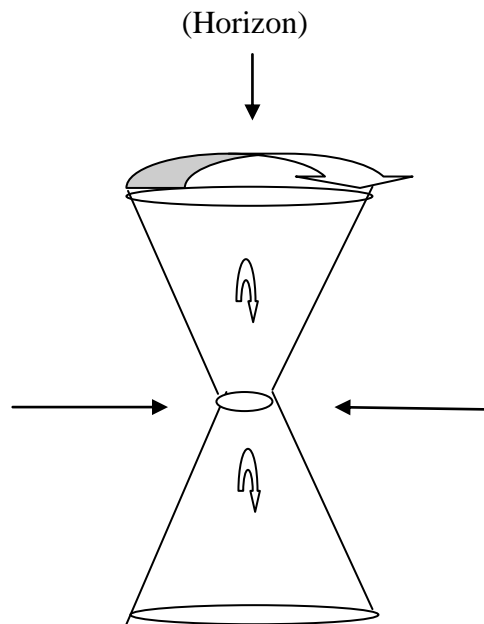


It is assumed that A&E had infinitesimal length (per microscopic nature of matter) and **Uniformly Distributed Density** with constant magnitude over differential length in vertical equilibrium. Compare our A&E model above with the recent experiment made by Dr. Igor Smolyaninov and his colleagues of the University of Maryland who used nanoparticles of cobalt and suspended them in kerosene. They then applied a magnetic field which, thanks to cobalt's ferromagnetic nature, arranged the particles into thin columns as in our A&E model. In space-time terms, the length of the columns in our A&E model is time, and the two axes perpendicular to the length represent the three spatial dimensions in our universe.

Those icy A&E were infinitely thin building blocks of matter, infinitesimally denoted in area calculations, as per John Wallis' calculus. Those primordial threads of matter must have had intrinsic magnetic properties with **spin ice monopoles** -- a north and south monopole.

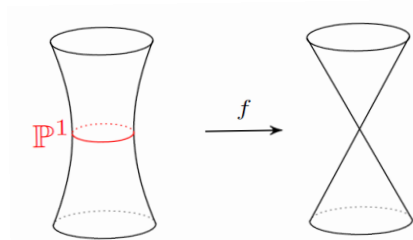
"Evidence for magnetic monopoles in spin ice shows predicted neutron scattering data" says Prof. Steve Bramwell of the London Centre for Nanotechnology, "in particular we have measured the monopole charge and observed monopole currents analogous to electricity. We have also used neutrons to measure the length of the so-called **Dirac strings** that run between North and South monopoles. The research shows how certain real materials, in this case spin ice, create within themselves things that resemble the basic particles by which the universe is composed. "The amazing thing about spin ice monopoles continues Prof. Bramwell, "is how perfect they are: they really do look just like those monopoles expected to exist somewhere in the universe. Why nature should reproduce a mini-universe within a material, we do not yet know".

The magnetic field around Adam and Eve’ “waist” had then configured them to a double-V structure, which then **rotated** and accumulated mass and volume to become the universal double cone space-time structure (fig. 3 below).

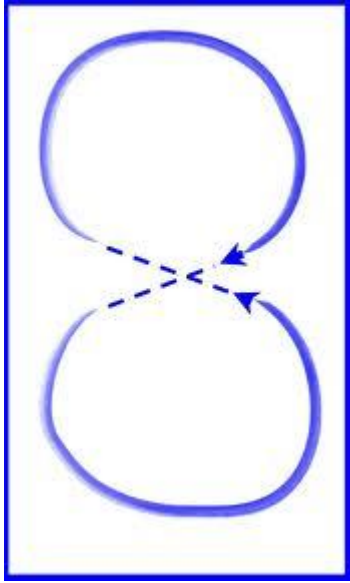


(Fig. 3, Creation, stage 2, double cone space-time model with a curved horizon due to rotation and inflated gases, and showing the downward movement of matter due to Coriolis effect in twin universes)

The **resolutions of singularities** below match the model above of the primordial (top cone) and our universe (bottom cone).



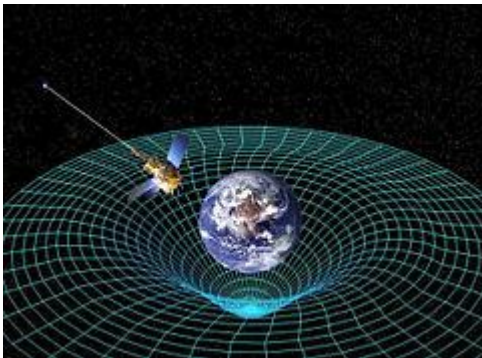
In fact, said double cone structure has an infinity projected 8-contour (fig. 3A), representing the corona of matter where energy circulates in a **Möbius band** (superconductive and polarized under magnetic field) in a partially visible and mostly invisible spectrum (dark energy in our universe), and where the inverse time-space travel is possible around double cone universes. (Charged particles that have been caught in the magnetic field of the earth can move on a Möbius band)



(Fig 3A)

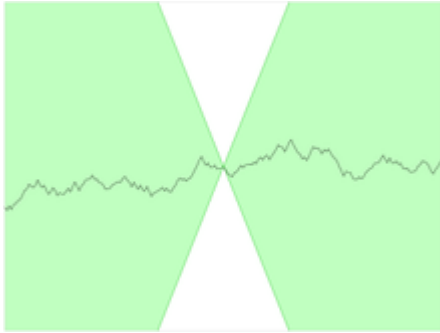
Ref.: in 1950, astronomer Bierman proposed that the centrifugal force generated in a **rotating plasma cloud** will separate out heavier protons from lighter electrons, thereby creating a separation of charge that leads to tiny electric and magnetic fields.

So, the rotational moment of our double cone universe created the first **horizon** (fig. 3 above) **and negative curvature of space** in the top cone (ill. 5 below).



(Ill. 5)

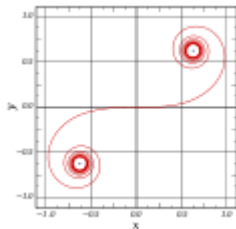
Thereby induced vortex attracted distant matter and forced it downward the top cone by Coriolis force in **Lipschitz continuity** (**ill. 6** below) where the outside magnetic field is still in action, encircling/preserving that structure in its narrow middle coupling.



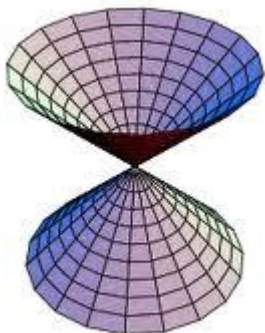
(**Ill. 6**)

For Lipschitz continuous function applied to a magnetic field, there is a double cone (shown in white above) whose vertex can be translated along the graph, i.e., the magnetic field always remains entirely outside the double cone's universal structure.

More to the notion of cosmic birth. Spiral form of each galaxy resembles an embryo with a quasi umbilical cord (**conic spiral**) spiraling toward the neighboring galaxy after separation of the initial cluster of galaxies (**ill. 7**) in a higher or lower part of the universe, per our double cone cross-like matrixes in two universes (**ill. 8**).



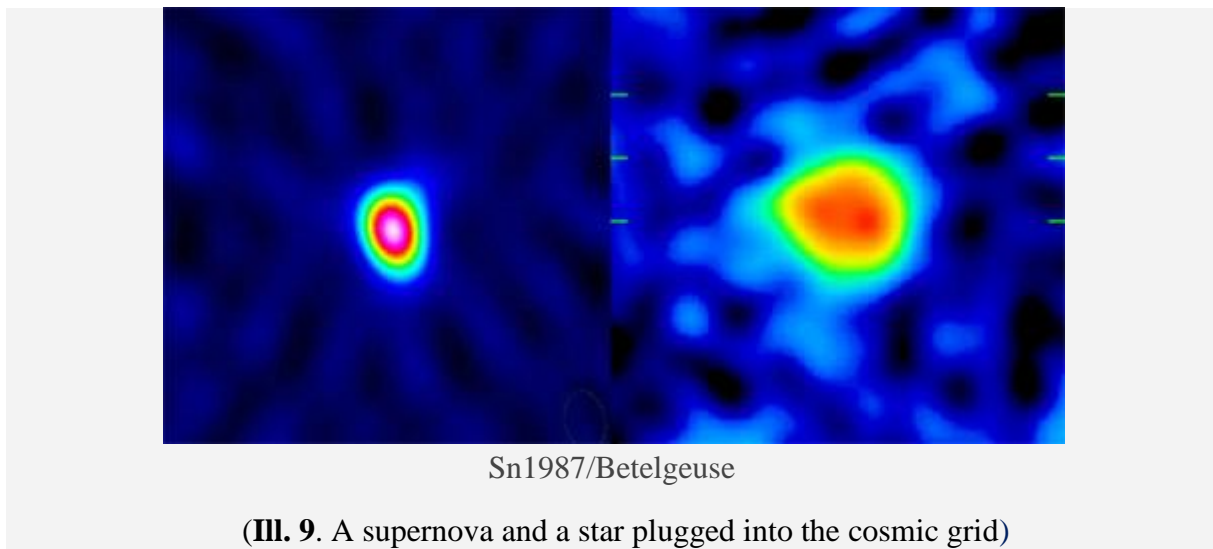
(Conic spiral, **ill.7**)



(**Ill. 8**)



There, in ill. 8, the space occupied by a galaxy is limited by its dimensional frame or the grid system as a certain energy barrier or boundary in space, separating the galaxies from each other (ill. 9).



From the medical biology we know that polymer gels coil and recoil under applied electric current, so a similar process might take place in the galaxies that were subject to the magnetic field which made them coil initially (contract) to sustain energy and then recoil (expand) in space-time continuum. (Compare with the mechanical device of a coil spring, which is typically used to store energy due to resilience and subsequently release it to absorb shock, or to maintain a force between contacting surfaces).

Hence, the downward spiral movement of matter in the funnel-shaped top cone (negatively curved space) of primordial universe in our model reminds the fall of sand in a common sand clock, with the difference that the sand just falls linearly under gravity, while cosmic structures have a rotational moment in a Coriolis effect. Space tunnel between connected cone universes in our model acts as **separatrix** - a boundary, separating negative and positive modes of the behavior of matter (**behavioral cosmology**). Strong electric fields exist inside the separatrix region where the electric potential drops, enabling the transition of matter from the negative charge in the top cone to the positive charge in the bottom cone of our double cone cosmic model.

We deal here with a new notion of *forward cosmic osmosis*, which is an osmotic process via semi-permeable magnetic field membrane to force the separation of the anti-matter from matter. The driving force for this separation is an osmotic pressure gradient, such that high density “draw” induces a net flow of particles through that membrane into our universe, thus effectively separating the antimatter from matter, with flux depending on the magnetofluid dynamics within the process itself set by the nonlinear evolution of these instabilities.

It is argued that cosmic plasmas are "three-scale systems," comprising global dynamics, mesoscale turbulence and microscale plasma fluctuations. The astrophysical example of cool cores of galaxy clusters is considered, and it is noted that the turbulence in clusters is in a marginal state with respect to plasma microinstabilities. So it is the **plasma microphysics** that is likely to set the heating and conduction properties of the inter-universal medium in our double cone structure.

(See kinetics of channelized membrane ions in magnetic fields: cyclotron resonance model for channel ion transport in weak magnetic fields. It is consistent with another reported phenomenon, that of quantized multiple conductances in single patch-clamped channels).

Chaotic dynamics of the Bianchi IX universe in Gauss-Bonnet gravity including a higher curvature mode might be applicable in our model. The presence of a cosmological constant creates a critical point of a **saddle type** -- spiral matter centered in the phase space (coupling joint) in our double cone system. The orbiting gas starting from a neighborhood of that separatrix had evolved toward the critical point and eventually expanded in both cones, but first in inflation in the top cone universe due to rotational mode of spatial phenomena, showing directional effects. (Rate of inflation can be calculated by **Fibonacci ratio**)

### New space-time model

The a.m. enables us to assume that the **negative primordial matter** coiled clockwise in the downward rotational Coriolis acceleration (ill. 10 below) in the top cone of our new universal model,



(ill. 10)

then passed in continuous acceleration via frame-drag vortex and recoiled counterclockwise as the **positive matter** in the bottom cone -- our universe in currently observed expansion in constant acceleration. Mass creates gravity, gravity creates pull, the pulling must slow the expansion, but the galaxies do expand and accelerate due to **Coriolis effect** in our double cone model and not due to the alleged dark energy or dynamic fluid that pushes galaxies apart, as previously presumed.

The observation that the light of the galaxies throughout our universe is redshifted is due to the **Doppler effect**, which reveals that the galaxies that are farther away are more redshifted than closer ones and are the fastest moving away from us due to **Coriolis effect**.

So in our space-time model the universe had changed its charge from anti-matter in the top cone to matter in the bottom cone, with no annihilation but in transfusion of energy, showing anti-neutrino remnants and beta decay that some considered the result of the Big Bang. That answers one of the pertinent questions in anti-matter physics: “why is our universe made almost entirely of matter?”

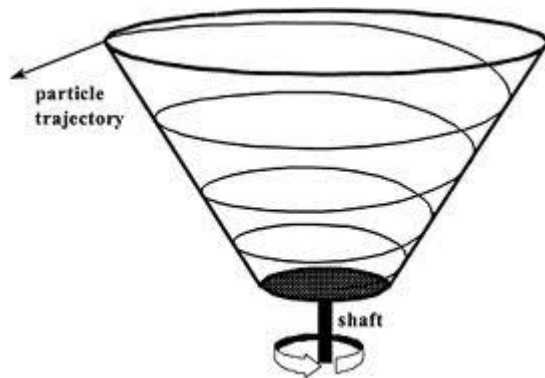
Because there was the **anti-matter universe** prior to our universe, and that’s why no anti-matter has been found in our universe, for the anti-matter is not precisely the three-coordinate mirror image of matter; there is in fact a *discrete symmetry* which flips a system from one state to another. This symmetry doesn’t have corresponding conservation laws, so per particle physics this explains the **transition** of anti-matter in the top cone of primordial universe to matter in the bottom cone of our universe as in our model.

“Our goal is to catch the moment when a system ceases to be quantum and becomes classical. This transition from one world to the other is called *decoherence*. It happens because the coherence of the system is somewhat disturbed by its macroscopic environment which forces it to take an unambiguous stand in the classical realm.” (Serge Haroche, 2012 Nobel Prize in Physics)

*Nota bene:* Coriolis effect in our model was caused by **rotating primordial universe**, and that force is responsible for the transition of primordial universe to its current stage as our universe. Our idea of the first universe of anti-matter is confirmed by its clockwise rotation in the top cone in our model, since negatively charged particles move in a clockwise orbit. And the fact is that our universe and galaxies rotate counterclockwise.

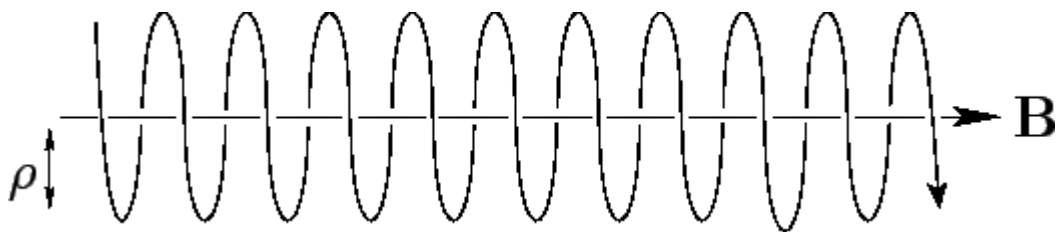
**Bekenstein Bound** is applicable here in a modified way: in our model the entropy is in a cone and not in a sphere as in Bekenstein equation, and the ever accelerating momentum of matter in a rotation frame of reference is per **Coriolis constant** in our rotating double cone universal model. There, the anti-matter reached the upper limit on the entropy in the top cone per **First Law of Thermodynamics** and then evolved into matter in the bottom cone of our universe per **Second Law of Thermodynamics**, i.e. the initial process of the evolution of primordial universe started at one state and ended in another, going in the direction of the downward directed entropy in our double cone energy system, plus the environment to increase for an irreversible process and to remain constant for a reversible process within a **given finite region of space which has a finite amount of energy** per Bekenstein.

So our new universal model represents the structural duality, polarity and rotation of the double cone system caused by its rotating frame structure, as it happens in a rotating cone reactor on earth (fig. 4 below).



(Fig. 4)

Drift of a **spiral** wave of matter in the top cone of our space-time model is induced by the magnetic field directed downwards within that cone. (In re: a proton moving at  $5.0 \times 10^4$  m/s horizontally enters a region where a **magnetic field** of 0.12 T is present, **directed vertically downward**). And we know that charged particles in a magnetic field always accelerate *perpendicular* to the particles' instantaneous direction of motion. The combination of circular motion in the plane perpendicular to the magnetic field and uniform motion along the direction of the field gives rise to **spiral** trajectory of a charged particle in magnetic field, where the field forms the axis of the spiral (fig. 5).

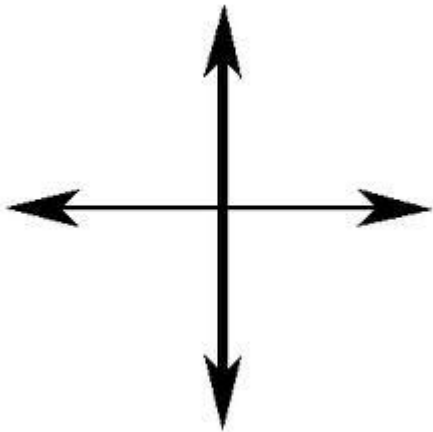


(Fig. 5)

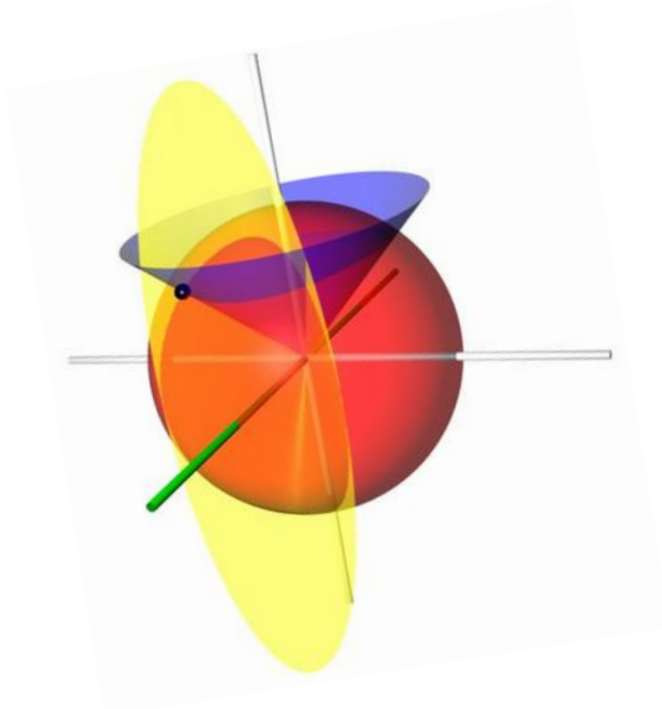
Our claim that the universe rotates from its creation is confirmed by a team of scientists from the University of Michigan led by Michael Longo, who while exploring the direction of rotation of 15 872 spiral galaxies, came to the conclusion that our universe may have been rotating about its axis as whirligig from its birth. In addition, the studies of these scientists actually disprove the hypothesis that the universe is isotropic and symmetric.

That research was conducted as a part of Sloan Digital Sky Survey (SDSS). At first, scientists tried to find evidence that the universe has the **properties of mirror symmetry**. In this case, they reasoned, the number of galaxies that rotate clockwise and those that are "twisted" in the opposite direction, would be the same.

However, it turned out that towards the north pole of the Milky Way, counterclockwise rotation among spiral galaxies is dominant, that is, they are oriented in the right direction. This trend is visible even at a distance of more than 600 million light years. This substantiates our space-time model of expanding universe that rotates counterclockwise in the bottom cone of its cosmic frame. Accumulated knowledge enables us to envision a universal structure where strings, actually **intertwined threads of matter**, constitute a quasi cross (fig. 6) in Cartesian conical coordinates (fig. 7 below),

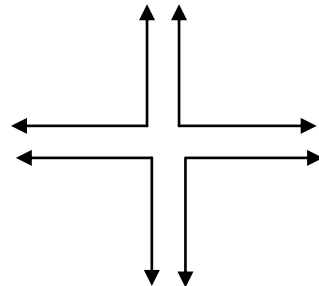


(Fig. 6, strings of matter in self-repelling gravitational pull and thereby achieved central equilibrium)



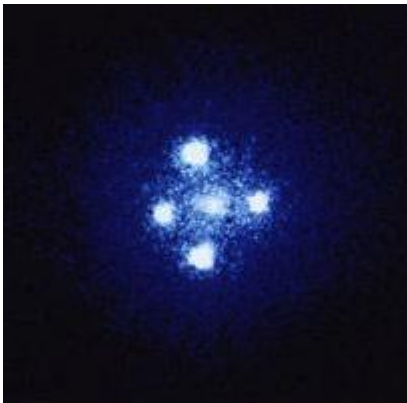
(Fig. 7. Coordinate surfaces of the conical coordinates)

In reality, both lines in fig. 6 above don't cross, for strings of matter do not intersect: their structure is composed of four aligned L- shaped parallel angular structures at 90 degree angle, constituting a combined cosmic system with integrated energy channels between the strings. (Fig. 8)



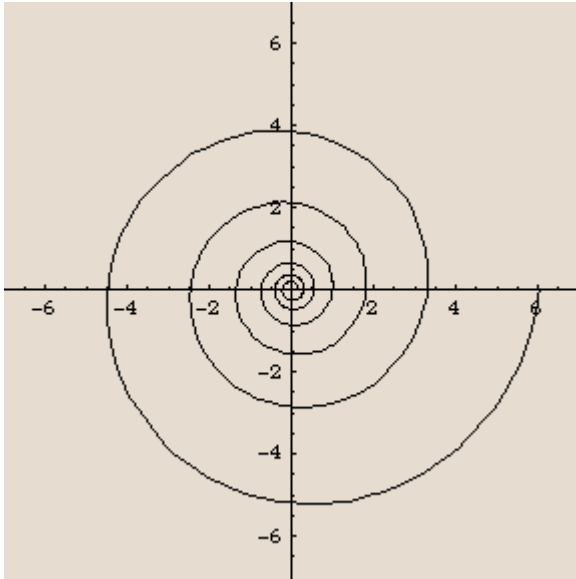
**Fig. 8**

This structure gives matter its angular momentum along **quantization axis**, with polarization vector of orthogonal projections of subatomic particles ( **ill. 16**, p. 62). Our cross structure of cosmic strings (fig. 6 and 8 above) has its actual confirmation in *Einstein cross* (Twin Quasar Q0957+561, **ill. 11**) which doesn't show a gravitational lens effect but pictures a cross of vertical and horizontal strings of matter with condensed plasma at the cross-point and at the ends of the strings, like the St. Elmo's light effect on earth.



(**Ill 11**. Using the Hubble Space Telescope, a friend of Halton Arp documented that quasar D (right side of photo) is physically connected to the nucleus of the galaxy. Later, a high redshift connection was discovered between quasars A (bottom) and B (top) which passes in front of the connection between the nucleus and quasar D).

To further substantiate our new theory, we show that our cross string structure has an integrated space-time dimension at its cross-point in the form of **logarithmic spiral** (**ill. 12** below) whose center represents the disc-core of the time-energy spiral, and that explains the flatness of its rotation curve, as in barred spiral galaxies (**ill. 13** below).



(III, 12,

13)

There (ill. 12 above), the sideways directed gravitational pull at the **nodes\*** of the horizontal string of matter contracts the space-time toward the center of that spiral (*a curve on a plane that winds around a fixed center point at a continuously increasing or decreasing distance from the point*), while the sideways directed gravitational pull at the nodes of the vertical string expands the space-time backward per **inverse-square law** in proportional quantity and intensity, forcing the **spiral timeenergy field** to coil and recoil as a pulsating perpetual structure (compare with a pulsar), securing thereby the eternal space-time continuum. (Certain types of pulsars rival atomic clocks in their accuracy in keeping time).

(\*For example, in a vibrating guitar string, the ends of the string where the wave has minimal amplitude are **nodes**. By changing the position of the end node through frets, the guitarist changes the effective length of the vibrating string).

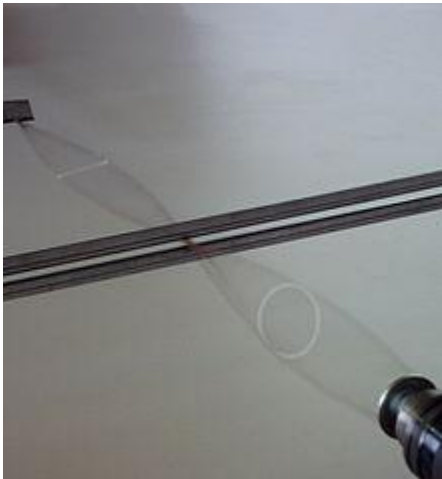
The elapsed time in the moving spiral frame will appear shortened or lengthen in the direction of motion, i.e., contracted or expanded in a linear transformation, including the rotation of space. A.m. strings of matter might be vast **standing waves** in which the distribution of field strength is formed by the superposition of two waves of the same frequency propagating in opposite directions.

The above mentioned effect in spiral spacetime represents a series of **nodes** (zero displacement) and **anti-nodes** (maximum displacement) at fixed points along the matter-energy transmission.

*In re:* Ken D. Olum, J. J. Blanco-Pillado, (Submitted 19 Oct 1999)

“Abstract: We have simulated large-amplitude standing waves on an Abelian-Higgs cosmic string in classical lattice field theory. The radiation rate falls exponentially with wavelength, as one would expect from the field profile around a gauge string.”

So the discussed here our double cone universal model was initially composed of the perpendicular strings of matter that acted *in coherence* as standing (stationary) waves with ideal property that enabled stationary (**primordial spatial constant**) interference of said two waves added together to create a wave of greater amplitude in *constructive interference*. That cosmic tsunami had excited primordial gases trapped and condensed by the strings of matter and created thereby the **packets or blocs of matter** to constitute the first, upper cone universe in our double cone model, as in ill. 14:



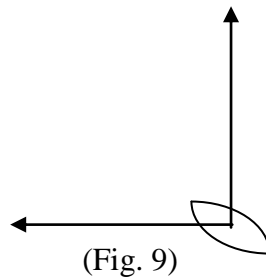
**Ill. 14.** Polarization on rubber thread. (Circularly→linearly polarized standing wave.)

One might ask how the gravitational pull was created in the strings of matter pointing in opposite directions, with no external force or point of attraction. The answer is that we deal here with the **warps of matter** as the set of lengthwise streams of particles held in opposing tension in said strings and **twisting** around those strings of matter, as a certain metal encapsulates a violin string in a spiral. Our warp concept is supported by a practical experiment conducted by Professor Sergey Lebedev's team in the Department of Physics at Imperial College London that sent a high-powered pulse of energy into an aluminum disk. In less than a few billions of a second, the aluminum began to evaporate, creating a cloud of plasma very similar to the plasma cloud surrounding a young star. Where the energy flowed into the center of the disk, the aluminum eroded completely, creating a hole through which a magnetic field from beneath the disk could penetrate.

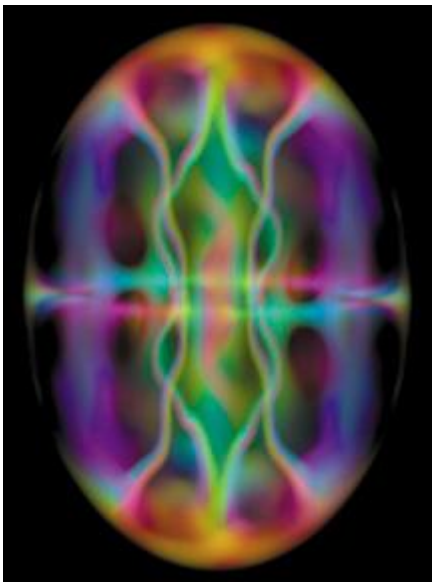


The field initially pushes aside the plasma, forming a bubble within it. As the field penetrates further and the bubble grows, however, the magnetic fields begin to **warp and twist, creating a knot in the jet.**

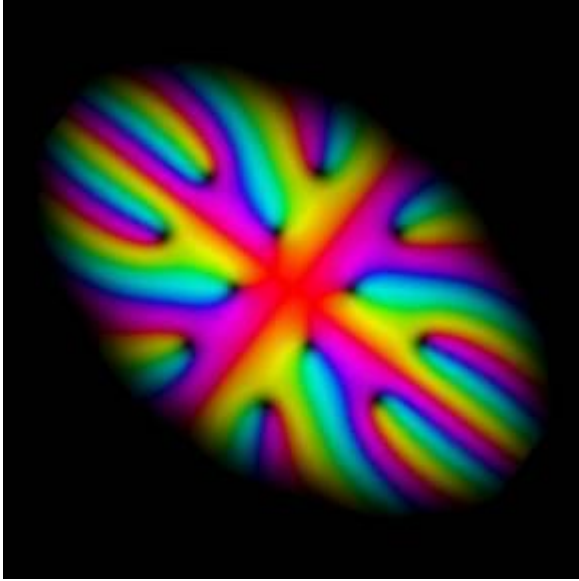
To discuss further the strings of matter constituting the primordial structure of space-time, we come to the notion of **repellent gravity**, as observed in galaxies. Due to anti-gravity in the strings of matter in our model, matter shifts toward the density points at the end of each string. Said strings are “**plugged**” at their low density vertex (fig. 9 below), representing a **plasma conductor in a vacuum loop**, which can withstand large gravitational pull. Dynamics of plasmas are often the sources of electromagnetic fields. ((Loop quantum gravity and **Aharonov–Bohm effect** might be applicable).



This corresponds with the **superfluid vacuum theory (SVT)**, sometimes known as the **BEC vacuum theory** -- an approach in theoretical physics and quantum mechanics, where fundamental physical vacuum (non-removable background) is viewed as superfluid or as a Bose-Einstein condensate (BEC, ill. 15, 16 below).



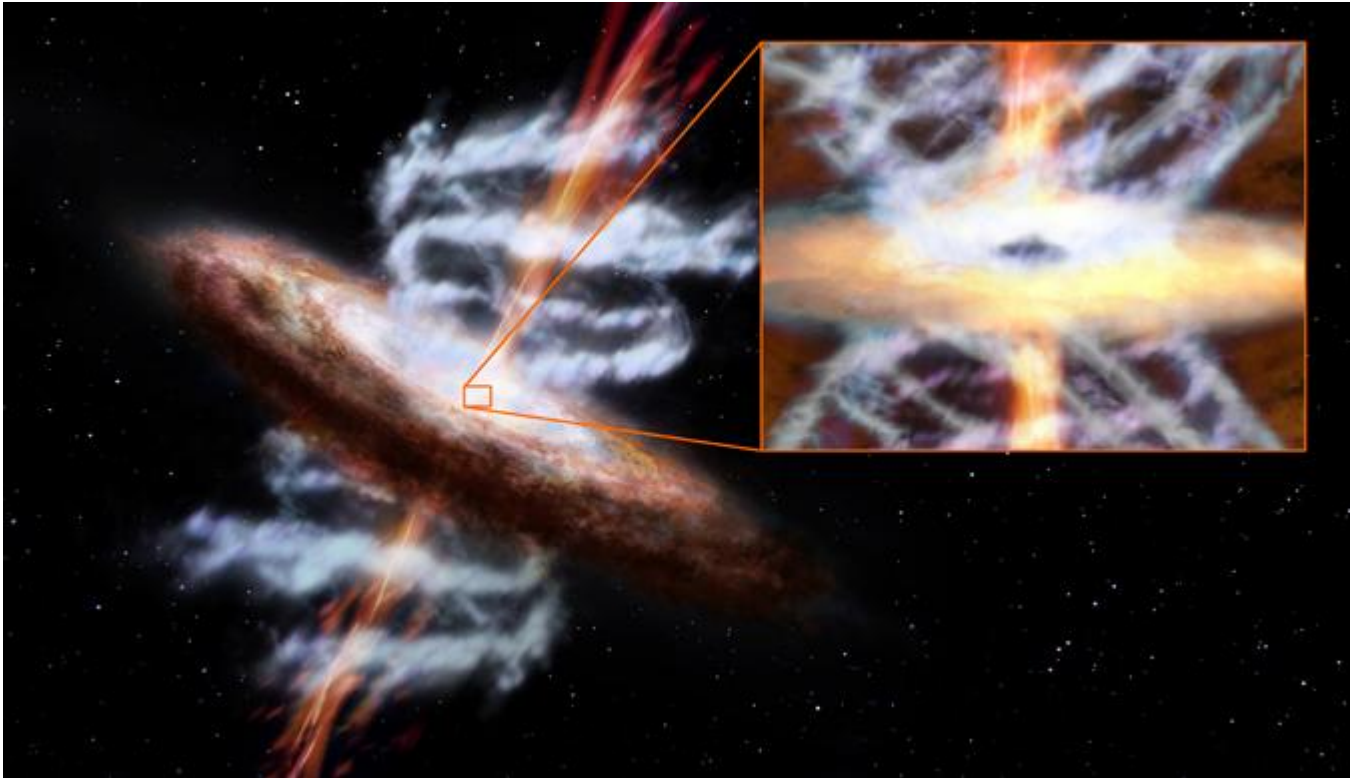
(Ill. 15. Emergence of vortex structure in a rotating Bose-Einstein condensate. From NIST Technology at a Glance, Fall 1999).



**(Ill. 16. Twelve-vortex array in a rotating Bose-Einstein condensate) -- resembles an electric plug.**

So our **spiral space-time model** in ill. 12 above, p. 59 consists of vertical strings of matter with integrated, horizontally rotating matter, spiraling downward from the cross-point due to Coriolis effect, as perceived in NASA' findings in the black holes (**ill. 17** below, p. 63), thus confirming our assumption of the processes that took place in primordial universe and in our universe still in formation via expansion in dual gravitational acceleration in the vertical entry and exit vortices due to Coriolis force.

Same spiral pattern of expansion in gravitational acceleration is observed in the galaxies.

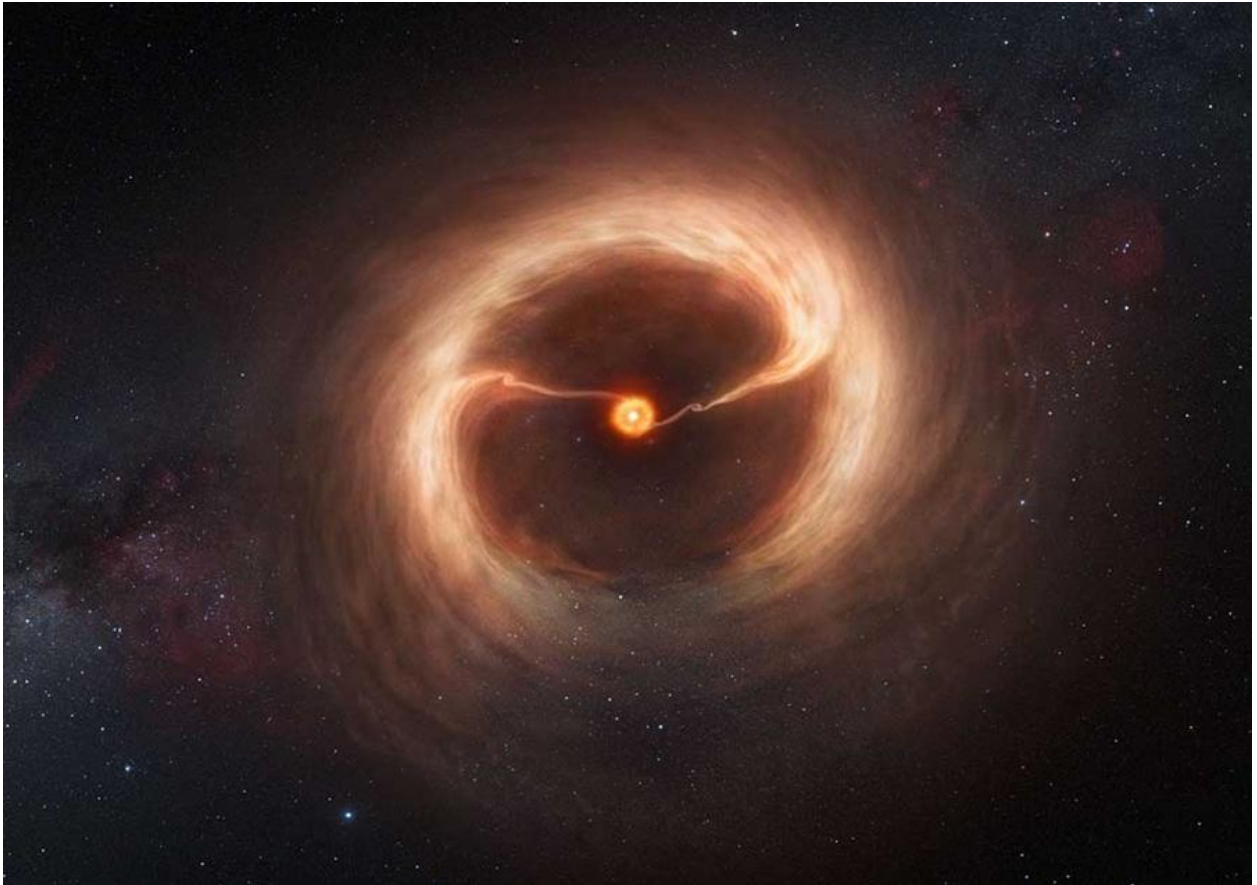


(**Ill. 17.** The supermassive black holes in active galaxies can produce narrow **particle jets** (orange) and wider streams of gas (blue-gray) known as ultra-fast outflows, which are powerful enough to regulate both star formation in the wider galaxy and the growth of the black hole. Inset: A close-up of the black hole and its **accretion disk**. (Artist concept credit: ESA/AOES Medialab)

“A curious correlation between the mass of a galaxy's central black hole and the velocity of stars in a vast, roughly spherical structure known as its **bulge** has puzzled astronomers for years. An international team led by Francesco Tombesi at NASA's Goddard Space Flight Center in Greenbelt, Md., now has identified a new type of black-hole-driven outflow that appears to be both powerful enough and common enough to explain this link. (<http://www.nasa.gov/topics/universe/features/fast-tflow.html>)”

That a.m. outflows have a double cone shape which might represent the circular polarization of gravitational waves as the reflection of the **double cone universal structure**, as in our model.

So, we came here to the pertinent question: how the primordial universe was created? We think that universal matter was attracted from any dimension, e.g. from the left and the right to the core of the **protouniverse** as in **ill. 18** below, p. 64.



(III. 18)

(This artist's impression shows the disk of gas and cosmic dust around the young star HD 142527. Astronomers using the Atacama Large Millimeter/submillimeter Array (ALMA) telescope have seen vast streams of gas flowing across the gap in the disk. These are the first direct observations of these streams, which are expected to be created by giant planets guzzling gas as they grow, and which are a key stage in the birth of giant planets. *Credit: ALMA (ESO/NAOJ/NRAO)/M. Kornmesser (ESO)*)

The matter then interacted and was forced in jet streams upward and downward from the nuclei, surrounded by the magnetic field as a **cosmic placenta** (ill. 19).

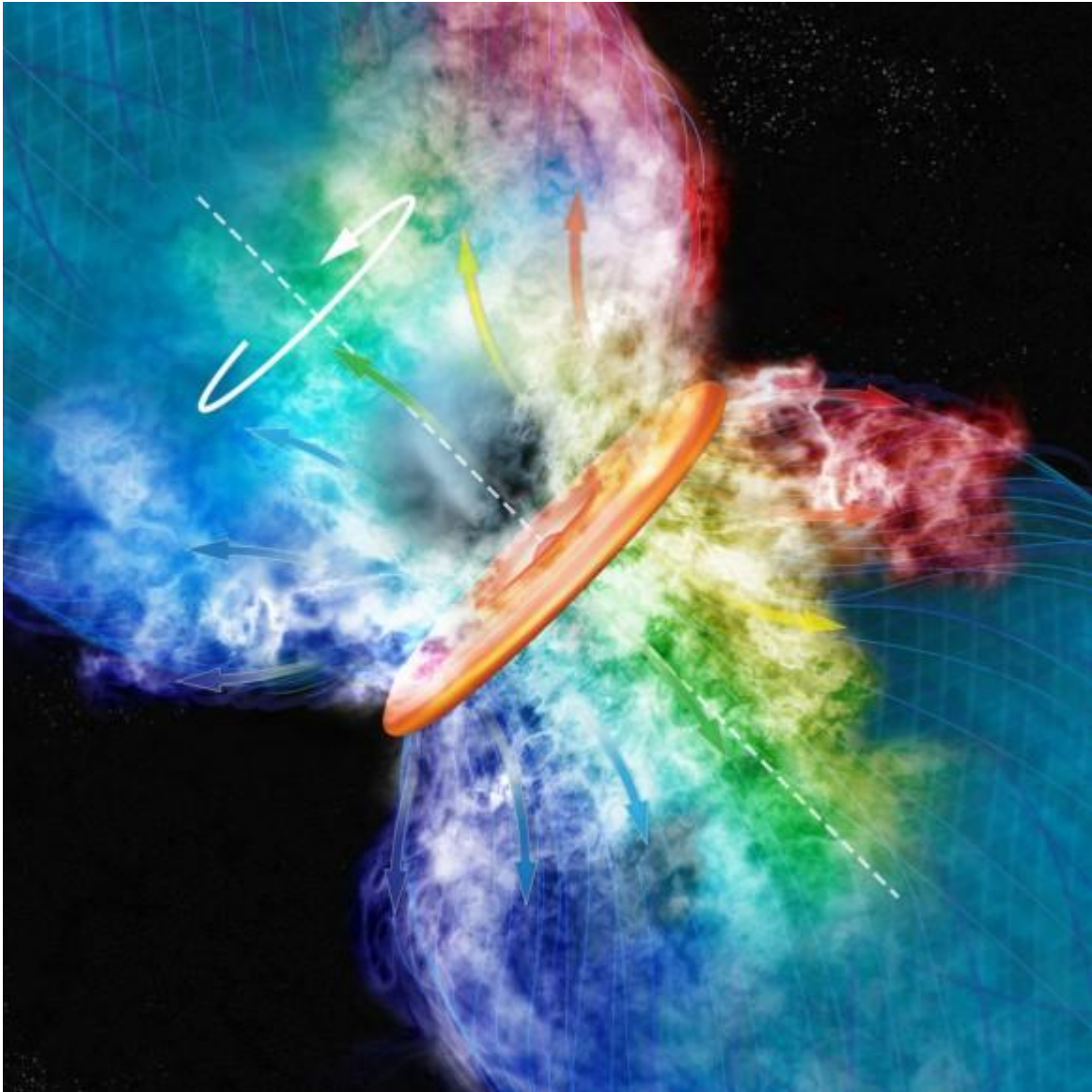


ill. 19

This could be the effect of the external magnetic field, acting as a containing sheath which is generated by the high-pressure gas, at the same time preventing it from falling apart. These containment fields have also been observed in similar jet streams spanning more than a million light years from the center of an elliptical galaxy.

*In re:* An astronomer wrote recently in the journal Physical Review Letters about a new mechanism for the magnetization of the early universe. Before stars formed, luminous matter consisted only of fully ionized gas of protons, electrons, helium nuclei and lithium nuclei. Schlickeiser found that magnetic fields fluctuate depending on their position in the plasma, regardless of time. Electromagnetic waves such as light waves fluctuate over time. The magnetic field in the plasma of the early universe was very weak, but covered almost 100 percent of the plasma volume.

Compare the image of the protouniverse (ill. 18 above) with ill. 20, below, artist's conception of the "boiling disk" surrounding the massive young stellar object known as Orion (source I. Credit: Bill Saxton, (RAO/AUI/NSF).



(III. 20. A two-year look at “proplyds,” or protoplanetary disks in the constellation Orion has provided astronomers with a new high-resolution time-lapse movie that reveals the process of how massive stars form. The birth of the largest stars has been mysterious, in part, because massive stars are rare and tend to spend their youth enshrouded by dust and gas hiding them from view. “We know how these stars die, but not how they are born,” said Lincoln Greenhill, a principal investigator for team using radio images) (<http://www.universetoday.com/45151/new-movie-reveals-birth-of-super-suns/>)

Hence, the primordial energy structure might have looked in our view like a system of quasi valves (III. 21 below, p. 67) – energy channels to pump (regulate, direct and control) the flow of pre-stellar gases.

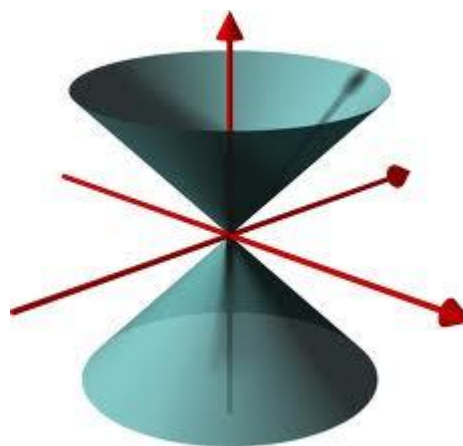


(III. 21)

Note that time in our new 4D spiral time-space model (ill 12, above, p. 59) is not a simple dimension, as in the light cone model in special theory relativity and Minkowski space-time, which is based on the assumption of a light source and observer on a hyper-surface of the present that doesn't exist in time, since it contradicts the Copernican principle of no special observer. (See explanation on p. 70, Concept of TIME)

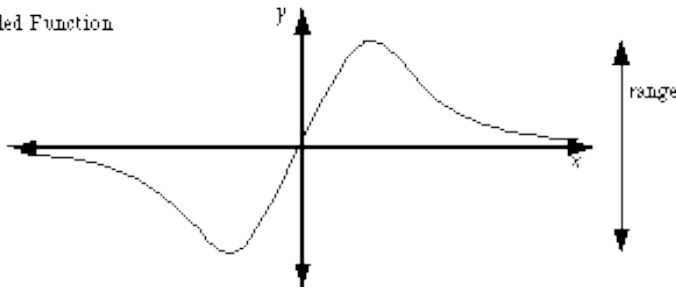
We claim accordingly that time is a wave -- a result of certain disturbance or event caused by applied force, and propagates for the distance and duration equal to accumulated energy.

So, our new **uniform space model** is represented by a double cone (ill. 22 below), where space-matter is three dimensionally framed by that double cone in quasi **bounded function** (math., where range must have both an upper bound and a lower bound (fig. 10 below, p. 68), and spreads with the help of the oscillating **spiral time-energy wave** within those given parameters, with no infinity.



(III. 22)

Bounded Function



(Fig. 10)

Our **spiral time-space model** (ill. 12, p. 59 above) corresponds with the **uniform field theory** and the **Grand Unified Theory** only with regard to space-time intersections as **coupling constants**, along which our spiral time-wave “slides” outward and backward on the horizontal and vertical strings of matter in our model and covers simultaneously the past and the future. When visualized in a similar process, the three-dimensional vortexes and tendexes of a  $(l,m)=(2,2)$  mode, and also a  $(2,1)$  mode, spiral outward and backward, becoming outgoing gravitational waves. (See ref. 1 in the appendix)

So this is a plausible explanation of the creation of **time-space** (time as a precursor of space to then constitute space-time) not provided by Einstein and other scientists, since the primordial spiral time-space matter must had been a **twin spiral** (ill. 23 below. The top one formed the primordial frame and horizon of the top cone protouniverse in our model as in fig. 4, p. 56, and ill. 22, p. 67 above) by creating volume and 3D space.

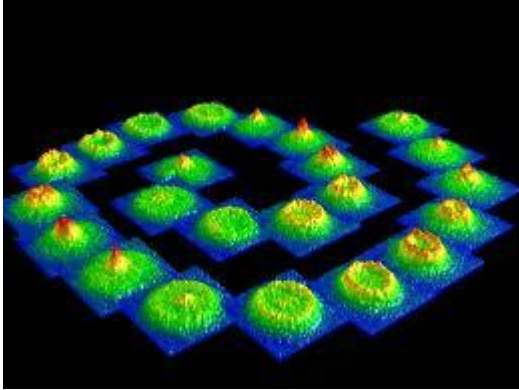


(Ill. 23)

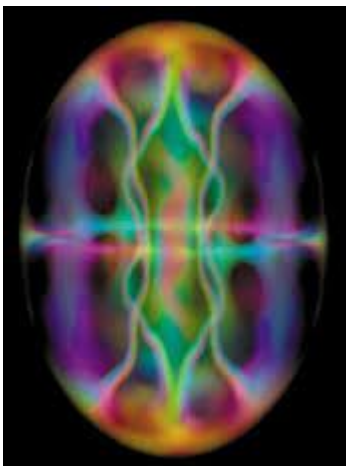
Same happened with the bottom spiral that formed the bottom cone – our universe. The expanding frame of both cones in ill. 22 was formed by same time-space spiral whose oscillating amplitude had first broadened up the top cone’s frame till its horizon, and then broadened down the bottom cone’s frame till its horizon. Note that we deal here not with the curvature of space-time per Einstein, but with **harmonic motion of matter** along the vertical “string” of space-time, reversing its upward motion back to the core-spiral in the center of the double cone as in **ill. 17**, p. 63 above. That was due to upper cone’s ballooning motion of hot primordial gases in a multidimensional **Brownian motion** within a bounded cone domain.



Those inflated gases then cooled in **Bose-Einstein** like condensation and spiraled (**ill. 24**) downward the disc-core located between the double cone in our time-space model, in its perfect visualization in the Bose-Einstein condensate image (**ill. 25** below).



(**Ill. 24**)



(**Ill. 25**)

(Homogeneous matter in that double cone core is wrongly perceived nowadays as the overhomogeneous early universe).

The a.m. spiral downflow of gases in our model was predicted by the theoretical model of a binary system where gas will spiral in and fall to the surface of the compact object creating a flow of matter in the shape of a disk. This model explains many features of X-ray pulsars.

Such oscillating **time-space continuum** explains the universal oscillation of particles, appearing in *resonant oscillation* at any part of the universe without traversing space. Such particles reverberate in unison with other particles and appear where they receive a consonant signal, subject to modulation and infinite number of frequencies in space, providing them with infinite number of propagations for time-space entry, exit and reentry. Similarly, a vertical string of matter can act in our **time-space cone** as a pendulum, oscillating about the core spiral and reaching its outer ends or horizon at ever new point.

This new knowledge of time-space oscillation (TSO, see ref. in appendix) enables us to construct a special spacecraft encapsulated by a stream of on-board produced charged particles, whereby when the mass of the outside energy capsule is equal or larger than that of the spacecraft, the latter won't travel commonly in space but will traverse it within the time capsule that would penetrate the space unimpeded, carrying the spacecraft through the time-matter continuum via the network of gravitational fields.

This space-time ship of no analogy can be at one end of the universe and then appear at the other end. It can be assembled on the moon by separate parts brought there by a spacecraft of our special design.

So, a new point of view of our universe elaborated above provides for panoramic view of the universe and enables to define and perceive *panoramic radiation*, observed so far in small segments as background radiation. For as light has many colors and wavelengths, so universal radiation must have many different frequencies and wavelengths of so far invisible spectrum.

## **THE CONCEPT OF TIME**

In 1964, when Yakir Aharonov, Peter Bergman, and Joel Lebowitz started to think seriously about the issue of the arrow of time in quantum mechanics, whether time only flows from the past to the future or also from the future to the past, they couldn't have possibly imagined that their esoteric quest would one day lead to one of the most powerful amplification methods in physics.

It means there are flaws in the previous space-time model per theory of relativity. In general relativity the gravity is described using non-Euclidean geometry, so that the gravitational effects are represented by the curvature of space-time, while special relativity is restricted to the flat space-time.

In our opinion, space-time cannot be flat if it rotates, is inflated and contains time as a dimension, since time is a wave equally propagated and not subject to gravity, for it has no mass, but inherent physical properties: actual space-time is infinite within its finite frame, as shown in our space-time model.

University of Queensland's scientists Jay Olson and Timothy Ralph claim that the quantum entanglement is a fundamental part of the universe, and it works both in space and time, so changing the state of particle today instantly changes the same particle in the future, even while the particle will not exist between those two points.

In 1977, Bailey, et al, accelerated a muon (a negatively charged subatomic particle about 200 times heavier than an electron) close to the speed of light, using the CERN Muon storage ring. **The accelerated muon's lifetime increased almost thirty times that of a muon at rest.** This time dilation effect suggests that the muon is able to travel to the future, since it continues to exist at a future time.

So we come here to the notion of the **velocity of time** which should be measured not by the speed of light and distance, but by the amount of comparable mass, accumulated energy and thereby acquired time acceleration of moving objects based on their universal and singular time-spans and chosen orbits applicable to humans, stars and galaxies in equation  $T=mv^2$ , **where T stands for time, m -- mass and v – speed of time squared.** (Note that Einstein's use of "C" in  $E=mc^2$  relates more to the fact that it is the speed where time and space are in some ways the same, than the fact that it was the speed of "light").

So per our  $T=mv^2$  the **accumulation of time** can take place in a black hole acting as a time-energy battery that accumulates energy and elapsed time of the exploding stars. There, time can be amplified by applied magnetic field and "borrowed" by our spacecraft to retrace the time of the past stars by using time as energy.

So the universe is made up of time, space and matter in **coherent correlation** of their physical properties. So what was first? Time, space, or matter? If there was no time-space density prior to creation of matter, there is no point of calculating the age of primordial universe. If the time preceded matter, it means that we live in our past. If the time was "born" along with matter, it must have "grown" with the matter as its integral part, representing its time-span and energy, since chemical and physical elements and living beings all have their space, time and energy limits.

Per our spiral universal model time is a wave. It is horizontally created and spreads when a physical object is born in a splash of time-energy wave (as a short "burst" or "envelope" of localized wave action in physics), and operates according to its wavelength which represents the time-span given by the nature to each object.

In future, advanced genetics could decipherer that wavelength to predict the lifespan of a human being.

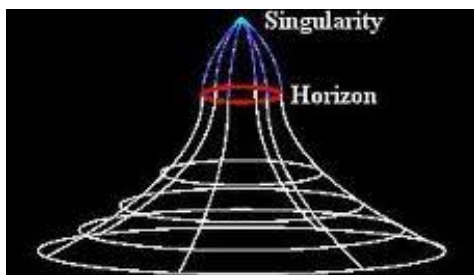
We formulate here a **new notion of time** without past and present. For example, a baby is conceived prior to its future birth in nine months, which is a small space-time event that progresses in given space-time continuum for that particular being, whose future is actually the movement back in time to the state of non-being, as a photon moves back in time.

As a physical object (including human beings) grows in height, width and weight, it gathers mass and density during the initial segment of its time which becomes the immediate past, with a remained segment of time still in the future. Such continuum has no place for present being, since time doesn't stand still for a second that immediately becomes a past time unit in the continuous flow of time. So, there couldn't be a permanent present observer as in the special theory of relativity.

We have determined here that time has just two interrelated segments – past and future, where past shortens the future for a relevant segment of time. That notion enables us to envision the past-future pass in time, where **time is quasi energy**.

It means that a living being or celestial body uses energy to grow, move and travel on earth and in space, leaving in its wake spent energy and time, which becomes thereby time-energy with kinetic properties to move the object in space and time. That past trace can be retraced in time travel back to the past if we consider the following time model that includes the **point zero** as initial space where any object is born or created. Spent years are minus zero, while future years are plus zero. When one year is past-lived (-1) it simultaneously becomes +1, i.e., the object becomes a year older in a simultaneous loss and gain of time. So, if we draw a line to the left of zero representing one year left in the past, same length section would progress to the right of zero, representing one year in the future, i.e., one year that went to the past is the recoil of the time-energy of the same year spent to gain a year in the future. So, the past can be traced back in time-travel along that pass, to be then retraced forward to the future for the same period of time.

In a nutshell, one year in the past propels one year into future, and it's not the same year, since past is not future and they cannot be superimposed. It means that time is not a simple dimension amongst other dimensions, but is a space coordinate and coordinating space event, as it helps coordinate events on earth. We accordingly envision the **time-space continuum as a perforated ribbon** with encoded events, black and white holes (ill. 26 below), as perforated data in first computers.



(III. 26, white hole is the theorized time reversal of a black hole)

We also think that time can be stretched as a rubber, to then return to its original length, so its elements can be traced back in time, as can be light.

For example, light of an extinguished star can still be seen on earth due to large amount of time to reach us. A special **atomic mirror** might reflect and reverse that beam of light and reach the star in its still existing past, thus space-time can be traversed by quasi riding on light beams in cosmos in a **time reversal of the particles of light**.

In that respect, **pulse-gravity technology** and time-space craft can be developed. The latter would be operated by its own magnetic field, pulsating to and fro around that craft, attracting itself to celestial bodies in its forward destination, at the same repelling itself from celestial bodies and clusters behind it. Time in such a craft might stand still, for it pulsates to and fro in equally spent segments of future and past, achieving thereby **time parity**. We can observe similar phenomena in quasi normal pulsations of Schwarzschild and Kerr black holes.

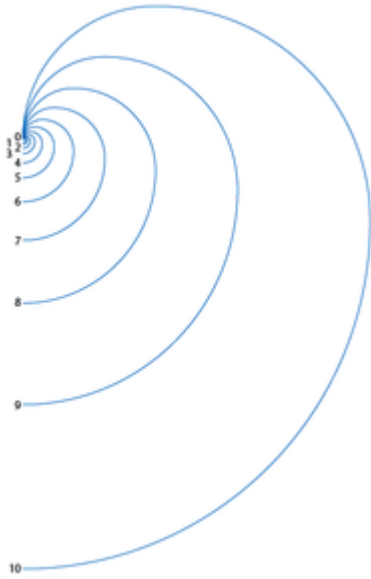
It implies that the UFOs might use the pulse time-energy technology, if they do exist. In general, a special spacecraft emitting a supercharged field can be encapsulated by a stream of trapped particles, evenly distributed over its entire structure in **magnetic parity mode**. That mode can be classified by radial quantum number  $n$ , spheroidal harmonic orders  $(l,m)$ , and parity, which can be electric  $[(-1)^l]$  or magnetic  $[(-1)^{l+1}]$ .

That can be compared on earth with the distribution of electricity over a human body, i.e., due to skin's strong resistance, high-voltage charge of a lightning spreads over entire body. That phenomenon is known as **external charge**.

Our spacecraft concept supersedes the *Alcubierre drive*, a speculative idea proposed by Miguel Alcubierre, by which a spacecraft could achieve faster-than-light travel if negative mass existed.

Rather than trying to exceed the speed of light within its local frame of reference, our spacecraft would traverse time by contracting space in front of it and expanding space behind it, resulting in **cause-and-effect space travel** regardless of the speed of light.

Having in mind our cosmic model, space-time travel is possible there not in a common linear way but via volutes of the time-space spiral, whereby a spacecraft would be catapulted in space similar to a stone thrown by a David' sling. Moreover, time travel is possible via multi-frequency **phi double spirals** (ill. 27 below), which is actually one phi spiral that expands infinitely from a given central point in various time segments in time differences.



(III. 27)

### **Conclusion**

To summarize,  $E=mc^2$  is insufficient to describe complex universal processes in dual universes, as in our double-cone model, since celestial bodies don't consume energy to traverse space, and the speed of light is irrelevant to them, for in most cases they are the source of light and are the light and energy, as our sun is. The only relevant constant in space is time, which, coupled with energy constitutes our universe, for even common clocks require mechanical, electric or atomic energy to function. Accordingly, here is a new equation to better explain the correlation between space, time and energy (matter and acquired mass), i.e.,  **$S=te^2$** , where **S is space, t – time and e – energy squared**, as the building block of space-time where time is multiplied by amount of energy needed to occupy particular space. It means that space is equal to its time and energy components, like jets of matter that **don't break into pieces — they are formed in pieces.**

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### **THE NATURE OF LIGHT**

With regard to double slit experiment, diffraction and probability theory, they do not reflect the true nature of light. If it is a wave and a particle, than we should consider its physical properties on earth compared with an ocean wave. The latter cannot exist without earth beneath it, sand and the rotation of the earth. So the water wave is created by the friction of the pressured water and sand and propagates in vortexes due to centrifugal force. When hitting the shore, the wave brings with it and leaves there a certain amount of sand particles and in retreating takes a certain amount of sand particles back with it, in a perpetual motion. If we would force a water wave through a slit, it would behave in the same wave as a photon, leaving a certain pattern via double, triple, etc. slit, whereby the water wave would encircle the obstacle and retreat via the slit and around the obstacle due to linear propagation of the wave in tidal gravitation.

Same effect of gravitational tidal forces acting on the virtual cloud of electron-positron pairs surrounding a photon propagating in curved spacetime can be observed in **superquantum propagation**. Accordingly, we assume that light is created by the friction of matter. It has non-linear, spiral form as that of the galaxies and split atomic particles. Light is observed as a frontal linear wave in a double slit experiment because we just see a fraction of a spiral quantum wave of visible particles patterns in a quantum vortex, while the rest of the quantum spiral which encapsulates the object remains invisible. What was considered as diffraction in a double slit experiment is in fact a nodal manifold pattern in quantum resonance similar to the nodal wave patterns on a Chladni plate.

So there is no diffraction, observation effect and the probability distribution with regard to **superquantum propagation**.

**Ref. Solomon Budnik**

**Subject: Research of Lunar Dust Properties for Quantum Electronics and Photonics**

**Abstract**

Lunar dust is levitated from the surface by powerful electrostatic charges generated by interplanetary radiation swirling across the landscape. In fact, electrical charges might even produce dust “fountains”. As the rising Sun's light and radiation sweep across the lunar surface they could generate large positive charges enough to levitate dust particles of active metals a mile high, until they drop back, only to get levitated again like a pulsing fountain.

## Research

1. We would accordingly investigate said levitating properties.

Investigations showed that lunar dust consist of meteorite particles of quartz and iron and other elements that are activated and levitated by the emissions of photoelectrons from the lunar surface which is charged **positive**, while the cloud of the photoelectrons above it is charged **negative**. Due to the difference of electric potential the electric field is created on the lunar surface and levitates the mini-particles of regolith – lunar soil.

*In re:* **Photoelectric Emission.** Electrons can be emitted from solids under irradiation with photons of sufficiently low wavelength. **Photoelectrons** are emitted when a single photon (quanta) of energy  $h\nu$  is absorbed by the solid, where  $h$  is Planck's constant and  $\nu$  the frequency of the light used. The *photoelectric effect* occurs when matter emits electrons upon exposure to electromagnetic radiation, such as photons of light.

### Overview of the Photoelectric Effect

2. The photoelectric effect is studied in part because it can be an introduction to wave-particle duality and quantum mechanics. When a surface is exposed to sufficiently energetic electromagnetic energy, light will be absorbed and electrons emitted.

### Einstein's Equations for the Photoelectric Effect

Einstein's interpretation of the photoelectric effect results in equations which are valid for visible and ultraviolet light:

energy of photon = energy needed to remove an electron + kinetic energy of the emitted electron

$$h\nu = W + E$$

where

$h$  is Planck's constant

$\nu$  is the frequency of the incident photon

$W$  is the work function, which is the minimum energy required to remove an electron from the surface of a given metal:  $h\nu_0$

$E$  is the maximum kinetic energy of ejected electrons:  $1/2 m v^2$

$\nu_0$  is the threshold frequency for the photoelectric effect

$m$  is the rest mass of the ejected electron

$v$  is the speed of the ejected electron



### **Key Features of the Photoelectric Effect (FE)**

3. The rate at which photoelectrons are ejected is directly proportional to the intensity of the incident light, for a given frequency of incident radiation and metal. No electron will be emitted if the incident photon's energy is less than the work function.

Applying Einstein's special theory of relativity, the relation between energy (E) and momentum (p) of a particle is

$$E = [(pc)^2 + (mc^2)^2]^{(1/2)}$$

where **m** is the rest mass of the particle and **c** is the velocity of light in a vacuum.

4. So in our research we would try to develop superconducting and levitating elements based on Photoelectric Effect, its upward kinetic energy and my new quantum field theory to create substances and devices that would enable large and heavy objects to levitate, to be used in infrastructure projects, transportation, manufacturing, renewable energy, aerospace, defense, etc.

## Appendix

### Ref. 1

## 3-D Harmonic Oscillator

Consider a particle subject to a central force  $\mathbf{F} = -k\mathbf{r}$  directed towards the origin and proportional to the distance away from the origin. Then

$$V(\mathbf{r}) = \frac{1}{2}k\mathbf{r}^2 = \frac{1}{2}m\omega^2 r^2 ,$$

with  $\omega = \sqrt{\frac{k}{m}}$  and  $\mathbf{F} = -\nabla(V(\mathbf{r}))$  .

The Hamiltonian is

$$H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 R^2 = \frac{p_x^2 + p_y^2 + p_z^2}{2m} + \frac{1}{2}m\omega^2 (X^2 + Y^2 + Z^2) = H_x + H_y + H_z .$$

The state space E can be written as a tensor product space,  $E = E_x \otimes E_y \otimes E_z$  .

$H_x$  acts in  $E_x$  ,  $H_y$  acts in  $E_y$  , and  $H_z$  acts in  $E_z$  . We know the eigenfunctions if  $H_i$  in  $E_i$  .

$$H_i |\phi_{n_i}\rangle = E_{n_i} |\phi_{n_i}\rangle = (n_i + \frac{1}{2})\hbar\omega |\phi_{n_i}\rangle .$$

$\{|\phi_{n_i}\rangle\}$  is an orthonormal basis for  $E_i$  .

$\{|\psi_{n_x, n_y, n_z}\rangle = |\phi_{n_x}\rangle \otimes |\phi_{n_y}\rangle \otimes |\phi_{n_z}\rangle\}$  is an orthonormal basis for E .

We have

$$H |\psi_{n_x, n_y, n_z}\rangle = (n_x + n_y + n_z + \frac{3}{2})\hbar\omega |\psi_{n_x, n_y, n_z}\rangle .$$

The energy levels of the three-dimensional harmonic oscillator are denoted by

$E_n = (n + \frac{3}{2})\hbar\omega$  , with  $n$  a non-negative integer,  $n = n_x + n_y + n_z$ . All energies except  $E_0$  are degenerate.  $E_0 = \frac{3}{2}\hbar\omega$  is not degenerate.

Problems:

For the three-dimensional harmonic oscillator the energy eigenvalues are  $E = \hbar\omega(n + \frac{3}{2})$  , with  $n = n_1 + n_2 + n_3$  , where  $n_1, n_2, n_3$  are the numbers of quanta associated with oscillations along the Cartesian axes. Derive a formula for the degeneracy of the quantum state  $n$ , for spinless particles confined in this potential.

Solution:

We have  $n=n_1+n_2+n_3$ , with  $n_i = 0,1,2, \dots$ .

For a given  $n$  choose a particular  $n_1$ . Then  $n_2+n_3=n-n_1$ .

There are  $n-n_1+1$  possible pairs  $\{n_2, n_3\}$ .  $n_2$  can take on the values 0 to  $n-1$ , and for each  $n_2$  the value of  $n_3$  is fixed. The degree of degeneracy therefore is

$$g_n = \sum_{n_1=0}^n (n - n_1 + 1) = \sum_{n_1=0}^n (n + 1) - \sum_{n_1=0}^n n_1 = (n + 1)(n + 1) - \frac{n(n + 1)}{2} = \frac{(n + 1)(n + 2)}{2}.$$

In one dimension, consider two particles of mass  $m$ , coordinates  $x_1$  and  $x_2$ , momenta  $p_1$  and  $p_2$ , and potential energy  $V(x_1, x_2) = \frac{1}{2}m\omega^2 x_1^2 + \frac{1}{2}m\omega^2 x_2^2 + \gamma m\omega^2 (x_1 - x_2)^2$ . Find the eigenvalues and eigenfunctions of the Hamiltonian  $H$  of the system.

Solution:

We have

$$H = \frac{p_1^2}{2m} + \frac{p_2^2}{2m} + \frac{1}{2}m\omega^2 x_1^2 + \frac{1}{2}m\omega^2 x_2^2 + \gamma m\omega^2 (x_1 - x_2)^2.$$

Let

$$x_G = \frac{1}{\sqrt{2}}(x_1 + x_2), \quad x_R = \frac{1}{\sqrt{2}}(x_1 - x_2), \quad p_G = \frac{1}{\sqrt{2}}(p_1 + p_2), \quad p_R = \frac{1}{\sqrt{2}}(p_1 - p_2).$$

Then

$$[x_G, p_G] = i\hbar, \quad [x_R, p_R] = i\hbar, \quad [x_G, p_R] = [x_R, p_G] = 0.$$

$$x_G^2 + x_R^2 = x_1^2 + x_2^2, \quad p_G^2 + p_R^2 = p_1^2 + p_2^2.$$

$$\begin{aligned} H &= \frac{1}{2m} \left( p_G^2 + p_R^2 \right) + \frac{1}{2}m\omega^2 \left( x_G^2 + x_R^2 \right) + \gamma m\omega^2 2x_R^2 \\ &= \frac{p_G^2}{2m} + \frac{1}{2}m\omega^2 x_G^2 + \frac{p_R^2}{2m} + \frac{1}{2}m \left( \omega^2 + 4\gamma\omega^2 \right) x_R^2 = H_G + H_R. \end{aligned}$$

$H$  is the Hamiltonian of two non interacting fictitious particle of mass  $m$  in harmonic oscillator potentials with frequency  $\omega$  and  $\omega' = \omega\sqrt{1+4\gamma}$  respectively.

The state space  $E$  is the tensor product space  $E=E_G \otimes E_R$ .

The eigenfunctions of  $H$  are tensor product functions

$$|\phi_{n_G} \rangle \otimes |\phi_{n_R} \rangle, \quad H_G |\phi_{n_G} \rangle = \left( n_G + \frac{1}{2} \right) \hbar\omega, \quad H_R |\phi_{n_R} \rangle = \left( n_R + \frac{1}{2} \right) \hbar\omega'.$$

$$E_{n_G, n_R} = \left( n_G + \frac{1}{2} \right) \hbar\omega + \left( n_R + \frac{1}{2} \right) \hbar\omega'$$

are the eigenvalues of  $H$ .

With  $\beta = \sqrt{\frac{m\omega}{\hbar}}$  and  $\beta' = \sqrt{\frac{m\omega'}{\hbar}}$  the corresponding eigenfunctions are

$$\psi_{n_G, n_R}(x_G, x_R) = \left(\frac{\beta\beta'}{\pi}\right)^{\frac{1}{2}} \frac{1}{\sqrt{2^{n_G+n_R} n_G! n_R!}} e^{-\frac{1}{2}(\beta^2 x_G^2 + \beta'^2 x_R^2)} H_{n_G}(\beta x_G) H_{n_R}(\beta' x_R)$$

Consider the one-dimensional problem in which an electron is placed in a harmonic oscillator potential  $V(x) = \frac{1}{2}kx^2$  and at  $t=0$  an electric field  $E = E_0 \hat{x}$  is turned on.

- Write down the Hamiltonian  $H$  for  $t > 0$ .
- Find the eigenvalues of  $H$ .
- Find the eigenfunctions  $f(x)$  of  $H$ .
- Find  $\langle x \rangle$  for all eigenstates of  $H$ .

Solution:

$$(a) H = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 x^2 + eE_0 x.$$

$$(b) H|\psi\rangle = E|\psi\rangle, \left(-\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + \frac{1}{2}m\omega^2 x^2 + eE_0 x\right) \phi(x) = E\phi(x), \quad \omega = \sqrt{\frac{k}{m}}.$$

Let us try to complete the square.

$$\left(-\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x^2} + \frac{1}{2}m\omega^2 \left(x + \frac{eE_0}{m\omega^2}\right)^2 - \frac{e^2 E_0^2}{2m\omega^2}\right) \phi(x) = E\phi(x).$$

Let

$$x' = x + \frac{eE_0}{m\omega^2}.$$

Then

$$\left(-\frac{\hbar^2}{2m} \frac{\partial^2}{\partial x'^2} + \frac{1}{2}m\omega^2 x'^2\right) \phi(x') = \left(E + \frac{e^2 E_0^2}{2m\omega^2}\right) \phi(x') = E'\phi(x').$$

This is the equation for a harmonic oscillator in the absence of an electric field.

$$E'_n = \left(n + \frac{1}{2}\right)\hbar\omega, \quad E_n = \left(n + \frac{1}{2}\right)\hbar\omega - \frac{e^2 E_0^2}{2m\omega^2}.$$

- The eigenfunctions associated with  $E_n$  are

$$\phi_n(x') = \left(\frac{\beta^2}{\pi}\right)^{\frac{1}{4}} \frac{1}{\sqrt{2^n n!}} e^{-\frac{\beta^2}{2} x'^2} H_n(\beta x'),$$

$$\phi_n(x) = \left(\frac{\beta^2}{\pi}\right)^{\frac{1}{4}} \frac{1}{\sqrt{2^n n!}} e^{-\frac{\beta^2}{2} \left(x + \frac{eE_0}{m\omega^2}\right)^2} H_n\left(\beta \left(x + \frac{eE_0}{m\omega^2}\right)\right).$$

- $\langle x' \rangle = 0$  for all eigenstates,  $\langle x \rangle = -\frac{eE_0}{m\omega^2}$  for all eigenstates.

## The one-dimensional harmonic oscillator in thermodynamic equilibrium

An important case of a statistical mixture is that of a system in thermodynamic equilibrium with a heat reservoir at temperature  $T$ . The various possible dynamical states are the eigenstates of the Hamiltonian  $H$ . The statistical weight of a given eigenstate depends upon the corresponding eigenvalue of  $H$ . It is proportional to the Boltzmann factor  $e^{-\frac{E}{kT}}$ , in which  $E$  is the eigenvalue of  $H$  and  $k$  is the Boltzmann constant. ( $k=1.38 \cdot 10^{-23}$  J/K)

A system in thermodynamic equilibrium is represented by the density operator

$$\rho = \sum_n p_n \rho_n = \sum_n p_n |\rho_n\rangle \langle \rho_n|$$

Let  $\{|\rho_n\rangle\}$  be the eigenstates of  $H$ .

$$H|\rho_n\rangle = E_n|\rho_n\rangle$$

Then  $p_n = Ne^{-\frac{E_n}{kT}}$ , where  $N$  is a normalization constant to make the total probability equal to one.

$$\rho = \sum_n Ne^{-\frac{E_n}{kT}} |\rho_n\rangle \langle \rho_n| = \sum_n Ne^{-\frac{E_n}{kT}} |\rho_n\rangle \langle \rho_n| = Ne^{-\frac{H}{kT}} \sum_n |\rho_n\rangle \langle \rho_n| = Ne^{-\frac{H}{kT}}$$

We need

$$\text{Tr}\{\rho\} = 1, \quad \text{Tr}\{Ne^{-\frac{H}{kT}}\} = 1, \quad \text{Tr}\{e^{-\frac{H}{kT}}\} = N^{-1}$$

$N^{-1}$  is called the **partition function Z**, and we write  $\rho = Z^{-1} e^{-\frac{H}{kT}}$ .

Let us calculate the partition function for the harmonic oscillator.

$$Z = \sum_{n=0}^{\infty} \langle \rho_n | e^{-\frac{H}{kT}} | \rho_n \rangle = \sum_{n=0}^{\infty} e^{-\frac{(n+\frac{1}{2})\hbar\omega}{kT}} = e^{-\frac{\hbar\omega}{2kT}} \sum_{n=0}^{\infty} e^{-\frac{n\hbar\omega}{kT}}$$

$$(1-x)^{-1} = 1 + x + x^2 + x^3 + \dots = \sum_{n=0}^{\infty} x^n$$

Therefore

$$\sum_{n=0}^{\infty} e^{-\frac{n\hbar\omega}{kT}} = \sum_{n=0}^{\infty} \left( e^{-\frac{\hbar\omega}{kT}} \right)^n = \left( 1 - e^{-\frac{\hbar\omega}{kT}} \right)^{-1}$$

and

$$Z = \frac{e^{-\frac{\hbar\omega}{2kT}}}{1 - e^{-\frac{\hbar\omega}{kT}}}$$

Let us calculate the average energy:

$$\langle H \rangle = \text{Tr}\{\rho H\} = Z^{-1} \text{Tr}\{e^{-\frac{H}{kT}} H\} = Z^{-1} \sum_{n=0}^{\infty} (n + \frac{1}{2}) \hbar \omega e^{-\frac{(n+\frac{1}{2})\hbar\omega}{kT}} = kT^2 \frac{1}{Z} \frac{dZ}{dT}$$

since

$$\frac{dZ}{dT} = \frac{d}{dT} \left( \sum_{n=0}^{\infty} e^{-\frac{(n+\frac{1}{2})\hbar\omega}{kT}} \right) = \frac{1}{kT^2} \sum_{n=0}^{\infty} (n + \frac{1}{2}) \hbar \omega e^{-\frac{(n+\frac{1}{2})\hbar\omega}{kT}}$$

Using  $Z = \frac{e^{-\frac{\hbar\omega}{2kT}}}{1 - e^{-\frac{\hbar\omega}{kT}}}$  we find a simpler expression for  $\frac{dZ}{dT}$ .

$$\begin{aligned} \frac{dZ}{dT} &= \frac{\hbar\omega}{2kT^2} \frac{e^{-\frac{\hbar\omega}{2kT}}}{1 - e^{-\frac{\hbar\omega}{kT}}} + \frac{e^{-\frac{\hbar\omega}{2kT}}}{\left(1 - e^{-\frac{\hbar\omega}{kT}}\right)^2} \frac{\hbar\omega}{kT^2} e^{-\frac{\hbar\omega}{kT}} \\ &= \frac{\hbar\omega}{2kT^2} Z + \frac{e^{-\frac{\hbar\omega}{kT}}}{\left(1 - e^{-\frac{\hbar\omega}{kT}}\right)} Z \frac{\hbar\omega}{kT^2} \end{aligned}$$

We now have

$$\langle H \rangle = \frac{1}{2} \hbar \omega + \frac{\hbar \omega}{\left(e^{\frac{\hbar \omega}{k T}} - 1\right)}$$

This is Planck's formula (to within a constant  $\frac{1}{2}\hbar\omega$ ) for the average energy of a quantized oscillator. The energy of a classical one dimensional oscillator is  $E(x,p) = \frac{p^2}{2m} + \frac{1}{2}m\omega^2 x^2$ . The mean energy of such an oscillator in thermodynamic equilibrium at temperature  $T$  is

$$\langle E \rangle = \frac{\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} E(x,p) \exp\left(-\frac{E(x,p)}{kT}\right) dx dp}{\int_{-\infty}^{\infty} \int_{-\infty}^{\infty} \exp\left(-\frac{E(x,p)}{kT}\right) dx dp} = kT$$

Temperature	QM oscillator $\langle H \rangle$	Classical oscillator $\langle E \rangle$
$T \rightarrow 0$	$\frac{\hbar\omega}{2}$	0
$kT \gg \hbar\omega$	$\frac{1}{2}\hbar\omega + kT\left(1 - \frac{\hbar\omega}{kT}\right) \approx kT$	$kT$
$kT \ll \hbar\omega$	$\frac{1}{2}\hbar\omega + \hbar\omega e^{-\frac{\hbar\omega}{kT}}$	$kT$

Note: For the three-dimensional harmonic oscillator in thermodynamic equilibrium the mean energy  $\langle H \rangle$  is three times that of a one-dimensional oscillator with the same frequency.

## **Ref. 2 Cosmic strings, loops, and linear growth of matter perturbations**

Wu, J.-H.-P., Avelino, P. P., Shellard, E. P. S., & Allen, B. (2002). Cosmic strings, loops, and linear growth of matter perturbations. *International Journal of Modern Physics D*, 11(1), 61-102. doi:10.1142/S0218271802001299.

**“Abstract:** We describe a detailed study of string-seeded structure formation using high resolution numerical simulations in open universes and those with a **non-zero cosmological constant**. We provide a semi-analytical model which can reproduce these simulation results including the effect from **small loops chopped off by the string network**. A detailed study of cosmic string network properties regarding structure formation is also given, including the correlation time, the topological analysis of the source spectrum, the correlation between long strings and loops, and the evolution of long-string and loop energy densities. For models with  $\Gamma=\Omega h=0.1-0.2$  and a cold dark matter background, we show that the linear density fluctuation power spectrum induced by cosmic strings has both an amplitude at  $8 h^{-1}$  Mpc,  $\sigma_8$ , and an overall shape which are consistent within uncertainties with those currently inferred from galaxy surveys. The cosmic string scenario with hot dark matter requires a strongly scale-dependent bias in order to agree with observations. “

## **Ref. 3**

### **TIME-SPACE-OSCILLATION**

#### **The Hidden Mechanism Behind Physics**

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**“Abstract.** Time-Space-Oscillation, TSO, is a comprehensive theory<sup>1;2)</sup> TSO considers the physical world as constituted of ( $\approx 10^{80}$ ) harmonic T-S-oscillators, approximately corresponding to the mass/energy of a neutron. TSO describes the physical phenomena by stoichiometric, simple equations and in terms of constitutive quantum parameters, i.e. the harmonic oscillatory amplitudes of force  $F_0$  and of time-space ( $A_T$ , and  $A_0=cA_T$ ). Together with the constants  $\pi$ ,  $c$  and  $\hbar$ , these parameters give quantitative accounts for both cosmic and quantum phenomena including the enigmatic formation of matter, mass and charge.”

#### **Derivation of the TSO-concept**

“The derivation of TSO is based on the fact that Einstein’s formula  $E=mc^2$  is not relativistic but identical to the old formula for oscillatory motion  $E=m(A_0\omega)^2/2$ , when the velocity amplitude  $(A_0\omega)=c\sqrt{2}$ . This unveiling enables a combination with Planck’s  $E= \hbar\omega$  and the work formula  $E=F_0A_0/2$ , which yields correct relations between the parameters, but not their exact harmonic values.

Thus the very clue to TSO is to determine its harmonic mass  $m_o$  or force  $F_o$ , which requires an intuitive extrapolation. It is evaluated by aid of the neutron mass to  $F_n=0,10136.10^7\text{N}$  and extrapolated to a  $\pi$ -function  $F_o= 10^7/\pi^2=0,10132.10^7\text{N}$ . This strong oscillatory force corresponds to the harmonic mass  $m_o$  of exactly one proton with a hidden positron plus one from the TSO-unit dissociated electron. When dissociated from the harmonic TSO, the electron becomes a weak oscillatory force  $F_e=1,000067.10^9\text{c}$ .”

### **A new insight in Physics**

“The new perspectives on physics appear in TSO as stoichiometric relations between the parameters thus obtained. The important parameters and their relations are. They reveal new connections and turn physics and QM into one causal science. But first of all, TSO necessitates the existence of two parallel worlds, our world of 3-D space and another of 3-D time, which is almost hidden to our senses.

One perspective presents Planck’s  $\hbar$  [ $\text{M}^2$ ] as an equilibrium constant according to the equations  $\hbar=F_o A_o A_T/2\sqrt{2}$  and  $\hbar=m_o c^2 m_o c\sqrt{2}/F_o$ , which even elucidate the very characteristics of the uncertainty principle. The latter equation describes the state of any “stationary” particle (if  $F_o$  and  $m_o$  are mutually adjusted). But if the energy and momentum of the particle is increased by an additional velocity, the equilibrium collapses and a secondary action pulse of space appears  $\hbar=nA_o^2[\text{M}^2]$  i.e. the de Broglie wave. Hereby Planck’s  $\hbar$  fits into classical and causal physics without need of any theory of relativity. But as subatomic entities are oscillators with individual phase constants, outside our control, our measurements will give values of only wave-statistical character. Physics is not probabilistic. It is causal but dependent on the oscillatory character of all fundamental quantum units.

An unexpected result is that the space and time amplitudes  $A_o$  and  $A_T$  are related to Planck’s length  $L_P$  and time  $T_P$  according to  $A_o^2=10^{41}L_P^2 F_o/c$ . It reveals that gravitation is the weak coupling between a space oscillator ( $A_o^2$ ) of this side and a time oscillator ( $A_T^2$ ) of the other side with  $G=2\sqrt{2}.10^{-41}.c^5/F_o^2=6,6718765.10^{-11}$ . The  $A_o^2/L_P^2$  ratio reveals the size or reach of Universe  $10^{41}\lambda= 1,32.10^{26}$  [M] and that each of its  $10^{80}$  TSO-units contributes an odd expansive force  $+F_o/\sqrt{2}$  on this side and an odd constricting force  $-F_o/\sqrt{2}$  on the other side, which balances it “



“The  $A_0/L_P$  ratio even elucidates the formation of mass and charge, and it enables an exact account of the elementary charge and the electron and proton masses. A study of how TSO-units accrete to composite oscillators, to deuteron,  $\alpha$ -particles and heavy nuclides, reveals a consistent Mendeleiev system for nuclides. It is constituted of up to 6 shells with the nucleons arranged in reiterated geometrical patterns. The study also shows that the strong nuclear force of present physics does not exist. The nucleons of a nuclide are simply kept together by the impact of the oscillatory force  $F_0$ . The elements designated as magic are just those, which have the maximal impact per utmost shell area.

An aspect of TSO is its limitation to two dimensions, meter [M] and second [S]. This may first appear as a drawback, but enables a “dimensional mathematics” of great value. By this mathematics the outcome of interactions between different physical phenomena and parameters can be pictured similar to reactions between substances in chemistry. Further it enables us to consider physical interactions from two sides, from the “physical” side with its intensity parameters of fields and forces and from the “stoichiometric” side with its constitutive parameters of space, time and mass. One example is that Planck’s  $h$  [ $M^2$ ] and the enigmatic Poynting vector  $S$  [ $S^{-2}$ ] describes the same interaction of energy flow, one from this side of 3-D space and the other from the other side of 3-D time. “

### **Future expectations**

“What can we expect of TSO in the future, beside an improved comprehension of physics in only two dimensions and a faster development of it? I here limit myself to hint at effects on chemistry and biology. In chemistry we can expect development of coherent molecules with atoms (not only electrons) oscillating coherently, similarly to photons in laser light. Hereby a bridge is erected between physics and animate matter including mind. Animate proteins appear as molecules, constituted of coherently oscillating atoms, which thereby can overcome thermodynamic restrictions and function as receivers and transmitters.”

### **Reference:**

- 3.. Sundén. 1994, 96 “Time Space Oscillation” Proceedings of the St. Petersburg conferences “Space, Time and Gravitation”
4. O. Sundén. 1998 ”The Hidden Time-Space-Mechanism” Apeiron Canada, vol 5 no 1-2, **TSO-Units - Relations, Values and Dimensions**

“TSO refers to the fundamental harmonic Time-Space-Oscillator that creates the physical world. This table contains the TSO-units, their values, their stoichimetric relations and their fundamental dimensions {which are only meter [M] and second [S]}. TSO relies basically only on the three natural constants  $c$ ,  $\hbar$  and  $\square$  plus the strong oscillatory force  $F_o=10^7/\pi^2$  (with impedance amplitude  $I_{mo}=F_o/c$ ) and the space amplitude  $A_o$  (with time amplitude  $A_T=A_o/c$ ). All other units are related to them and to each other as indicated in this table. The fundamental harmonic mass appears in TSO as  $m_o=I_{mo}A_T/2= 1,674557.10^{-27}$  kg [S], a mass that does not correspond to a single particle but to one proton including a hidden positron plus one dissociated electron. As we here count with amplitudes the factor  $1/\sqrt{2}$  frequently appears, which here corresponds to the half period averaged value of the amplitude units. At the end of the table also the dissociated electron units are given together with the gravitational constant  $G$  as it appears in TSO and  $\hbar$  as it is related to the harmonic mass  $m_o$  and to the inharmonic mass of the electron  $m_e$ .”

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“In recent papers, we and colleagues have introduced a way to visualize the full vacuum Riemann curvature tensor using frame-drag vortex lines and their vorticities, and tidal tendex lines and their tendicities. We have also introduced the concepts of horizon vortexes and tendexes and **three-dimensional vortexes** and tendexes (regions on or outside the horizon where vorticities or tendicities are large). In this paper, using these concepts, we discover a number of previously unknown features of quasinormal modes of Schwarzschild and Kerr black holes. These modes can be classified by a radial quantum number  $n$ , spheroidal harmonic orders  $(l,m)$ , and parity, which can be electric  $[(-1)^l]$  or magnetic  $[(-1)^{l+1}]$ . Among our discoveries are these: (i).

There is a near duality between modes of the same  $(n,l,m)$ : a duality in which the tendex and vortex structures of electric-parity modes are interchanged with the vortex and tendex structures (respectively) of magnetic-parity modes. (ii) This near duality is perfect for the modes' complex eigenfrequencies (which are well known to be identical) and perfect on the horizon; it is slightly broken in the equatorial plane of a nonspinning hole, and the breaking becomes greater out of the equatorial plane, and greater as the hole is spun up; but even out of the plane for fast-spinning holes, the duality is surprisingly good. Electric-parity modes can be regarded as generated by three-dimensional tendexes that stick radially out of the horizon. **As these “longitudinal,” near-zone tendexes rotate or oscillate, they generate longitudinal-transverse near-zone vortexes and tendexes and outgoing and ingoing gravitational waves.** The ingoing waves act back on the longitudinal tendexes, driving them to slide off the horizon, which results in decay of the mode's strength. (iv) By duality, magnetic-parity modes are driven in this same manner by longitudinal, near-zone vortexes that stick out of the horizon. (v) **When visualized, the three-dimensional vortexes and tendexes of a  $(l,m)=(2,2)$  mode, and also a  $(2,1)$  mode, spiral outward and backward, becoming outgoing gravitational waves.”**