QUANTUM DEVICES
QUANTUM HARMONICS IN QUANTUM ENGINEERING

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Abstract

In this article we offer to enhance the standard model of a bosonic superconducting cosmic string (fig 1) and model it in our **quantum harmonic system** (fig. 2) to enable the creation of flexible (folded) quantum computers, IPhones and TVs, engineless quantum transmission and propelling devices for cars and aircrafts, superfluid propulsion, levitation and teleportation (see reference) based on three fundamental laws of physico-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), (3) the law of equal *a priori* probabilities. It is shown that all three 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.

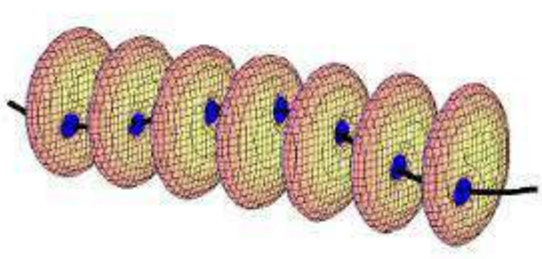

Fig. 1

Equations for 3D harmonic oscillator of our **quantum harmonic system** are in a separate paper**.**

Elaboration

Accordingly, and contrary to the common bosonic string model in fig 1, we model our ultracold hollow cylindrical superstring (fig 2) as a spacetime piercing quantum tube within the overlapping counter-rotating magnetic fields. (Compare with the spacetime piercing ability of neutrinos and their left-right counter-spinning ability).

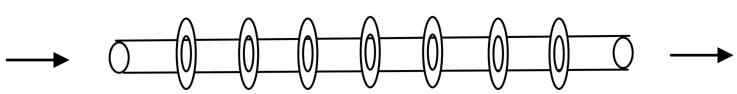

Fig. 2

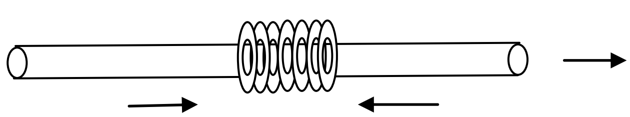

Fig. 3

Our tunneling superstring system in fig. 2 consists of the open left entry to trap fermionic atoms in the vacuum vortex core, where quantum Hall effect (QHE) is realized in a 2d electron gas subjected to a strong perpendicular magnetic field (see fig. 3) under the influence of the nuclear spin fields that are then harmonized in vertex by shifting counter-rotating magnetic fields in **dynamical Casimir effect** (see ref.1 below) to unify them in a superimposed magnetic field in quantum squeezejunction (fig 3) to then superconduct them via superstring's open right exit in mass propagation 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 photons (energy). The system in fig 3 functions similar to musical squeezebox harmonika or accordion (see image below) which expands and contracts its bellows by using trapped air to create pressure and vacuum and produce musical sounds.

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 a system can be modeled as a carbon tube with grapehene membrane, integrated within 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. (See ref. 2 at the end of this paper). To make this system work as a 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.

Our quantum model 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 be the Lagrange function of a point particle in the inertial system as follows:

$$L_0 = \frac{m v_0^2}{2} - U \tag{1}$$

with the following equation of motion

$$m \frac{D v_0}{dt} = \frac{\partial U}{\partial r'} \tag{2}$$

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,

$$\frac{d}{dt} \frac{\partial L}{\partial v} = \frac{\partial L}{\partial r} \tag{3}$$

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 sliding external magnets. Said tube 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 explains the phenomenon of wave particle duality in perpetual mobile of the in-and-out flows of matter and energy in a black hole, representing the ebb and flow in the ocean of spacematter.

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**) automatically 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 picture also dissolves the mystery of mass generation, the question of how the Higgs boson gets its mass, because it portrays **mass generation similar to the gap generation mechanism in superconductors or superfluids**. In other words, mass become a consequence of symmetry breaking quantum **vortices** forming in the vacuum condensate.

Conclusion

Because our ultracold superstring in fig. 2 above is nonrelativistic, it is not constrained to the multidimensional spacetimes in which superstrings are usually studied in high-energy physics. Our string is the actual **harmonic condensed matter system**, where superconductviity in **macroscopic quantum phenomena** can be studied experimentally. Accordingly, this theory and model and our **THEORY OF AUGMENTED QUANTUM REALITY** enable to create a **superfluid propulsion system**, **quantum computers, IPhones and TVs, nanoturbines** for cars, aircrafts and power stations, and **quantum generator** for portable cold fusion energy. In further application of our technology, new class of vehicles can be operated in levitation and superfluid propulsion, and the energy teleported.

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

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, and hence cannot be detected by gravitational waves. When twin superstrings of matter create a macroscale black hole, as explained in our 11 pp. **Theory of Unified Matter**, we might 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: Viewpoint: Modeling Quantum Field Theory

Jeff Steinhauer, 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.

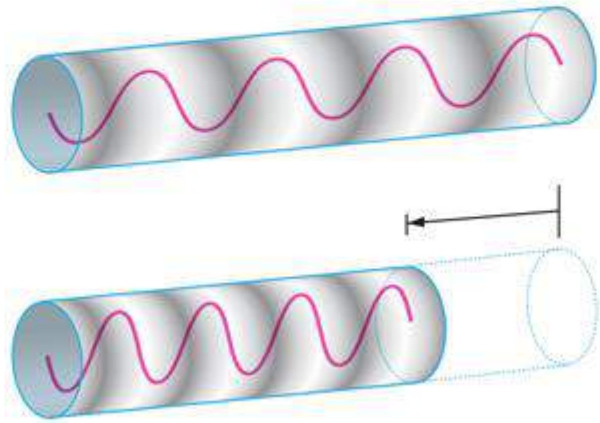

Figure 1: A resonator for the dynamical Casimir effect. The initial length of the resonator is shown in the upper illustration. The sine wave represents one of the modes of the resonator, initially populated by vacuum fluctuations. The length of the resonator is suddenly changed (lower illustration). 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/ħ, where *m* is the mass of the particles. Thus, to produce an electron-positron pair, an electric field of 1018V/m is required, giving an acceleration of 1029 m/s2 . 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 10−13m .

The event horizon of a black hole can also convert pairs of virtual particles (such as photons) to real particles, which ar 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 1020m/s2 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.* [9], 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 [9].

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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Impermeable Atomic Membranes from Graphene Sheets

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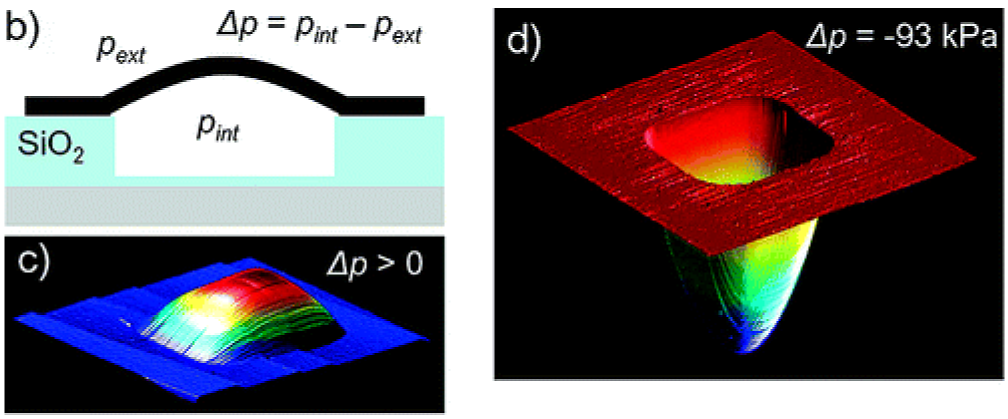
The conduction and the valence band in graphene touch at two inequivalent points (K and K′) at the corners of the Brillouin zone. Around those two points (termed "Dirac points"), the energy dispersion relation is linear and the electron dynamics appears thus "relativistic" where the speed of light is replaced by the Fermi velocity of grapheme (≈ 106 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 e v n B n F= sgn( ) 2 h 2 , where e and h are electron charge and Plank'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."