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On the Technical Possibility of Transmitting an Impulse of Movement at Superlight Speed

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Abstract

It is known that exceeding the speed of light is contrary to the laws of physics. However, Newton's pendulum is known, which transmits the impulse of oscillatory motion through several balls. These balls hang on parallel threads and fit snugly together. In this case, the momentum of movement is transmitted from one extreme ball to another without the movement of intermediate balls. In this case, with a pendulum length $L = 0.29979 \cdot 10^9$ m, with a half-period of oscillation of the pendulum $T < 0.5$ s, it is in principle possible to exceed the speed of light without violating the laws of relativism, since there is no real motion of mass in the pendulum. However, the presence of a significant mass of balls as a measure of the inertia of a physical body imposes restrictions on the speed of momentum transfer.

Aim: ***The aim of the work*** *is to eliminate this drawback by reducing the mass of contacting objects.*

Scientific Novelty: *The* ***scientific novelty of the work*** *is the substantiation of Newton's pendulum of the atomic-molecular level and the possibility of transmitting motion impulses on it.*

Methodology: *The* ***research methodology*** *based on the general principles of the dialectics of nature and non-contradiction to the known laws of physics.*

Results: *The* ***results of the work*** *- the design of the Newton's pendulum of the atomic-molecular level, which consists of 3 nanotubes, the gap between which provides a linear arrangement of molecules, is proposed. On this basis, an experiment on the transfer of the impulse of motion is proposed, which can be carried out on the basis of the LIGO observatory. This requires nanotubes of great length (more than a thousand meters), which poses the further task of their manufacture.*

Conclusions: *At the same time, the involvement of scientists and technicians and the financing of the project ensure the possibility of its implementation.*

Keywords: Speed of Light in Vacuum, Momentum of Bodies, Newton's Pendulum, Nanotubes for Molecules and Atoms.

Introduction

The work is related to the fields of applied and theoretical physics of the atomic-molecular level, in particular, to the principles of motion momentum transfer by chains of linearly located atoms and molecules.

The study of these issues is an important and relevant task, because it expands the level of knowledge of the material world, in particular – knowledge of the possible processes of motion momentum transfer during the physical interaction of atoms and molecules; possible limiting speeds of this transfer and their restrictions by relativistic laws.

The application of the results of this work is possible in various fields of science and technology of nano-, micro- and macrolevels, which will contribute to their further development.

Analysis of the State of the Problem and Setting Research Objectives

Currently, the speed of interaction of objects, physical fields and other systems of the material world is limited by the speed c of light in vacuum [1].

$$c = 0.299792458 \cdot 10^9 \left(\frac{m}{s}\right) \quad (1)$$

This stems from the fact that, in the framework of the concepts of A. Einstein's relativistic physics when the object reaches the speed of light $\upsilon_o = c$, its size *l (2)* and mass *m* (3) increase infinitely, and of the causal-relationship connection of interactions changes [2].

$$l = \frac{l_o}{\sqrt{1 - \frac{\upsilon_i^2}{c^2}}}(m). \quad \textbf{(2)}$$

$$m = \frac{m_o}{\sqrt{1 - \frac{\upsilon_i^2}{c^2}}}(kg). \quad \textbf{(3)}$$

where l_o, m_o – initial length and mass of an object;
υ_i – current speed of an object.

However, within the framework of gravitational interactions of stars, professor Nikolai Kozyrev (Russia) recorded the phenomena of "instantaneous" obtaining information about their real position: a), which differ from the positions determined in the usual way – through their of light emission: b) (Fig. 1), by due to of lagging of information about their true position for the time needed for the light in vacuum to overcome the distance from a star to an observer [3].

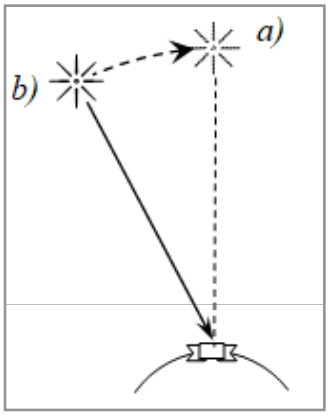


Figure 1: Scheme of passage of a beam of light from a star to an observer (b) and her real location (a) at the moment

Although these facts are controversial, a number of works by professors A. I. Veinik [4], G. I. Shipov and A. A. Akimov also allow making a similar conclusion indirectly [5]. Explanations of the phenomenon can be obtained within the framework of nonlocal quantum theory but it has not yet been worked out rigorously enough [3, 6].

The **scientific novelty** of the work being performed is a rigorous substantiation of the possibility of the motion momentum transfer of material objects (or information about this motion) with a speed exceeding the speed of light, while eliminating contradictions with Einstein's theory of relativity.

The **main objective of the work** performed is the development of fundamental principles and real devices for determining velocities exceeding the speed of light in vacuum. A properly developed strategy for the implementation of such studies allows choosing the most effective ways, and costs – time, material and labor resources.

The **research methodology** is based on the general principles of the dialectics of nature and non-contradiction to the known laws of physics.

Finding ways to achieve the objective set: to solve the task, a fundamentally new approach has been proposed, which is related to the possibility of motion momentum transfer in Newton pendulum. Its general view is shown in Fig. 2. a, b. It consists of n number of identical pendulums, consisting of balls suspended on a long thread, which are in contact with each other. Each such individual pendulum is a physical model of a mathematical pendulum: Newton pendulum can have any length and many numbers of balls (Fig. 2.b)

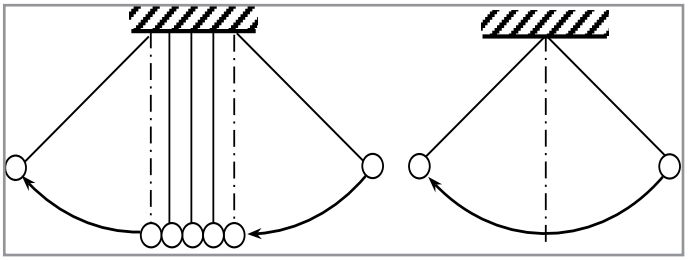
a)

b)

Figure 2: General view of Newton pendulum in the minimum (a) and elongated (b) versions.

The peculiarity of Newton pendulum is that the motion momentum from the swinging of the extreme ball (Fig. 3.a) is transferred through all intermediate balls to another extreme ball, which continues the swing trajectory of the first ball of the pendulum. These swinging, within the limits of the accuracy of the experiments, coincide with the swinging of a similar pendulum on a thread with one ball, both in amplitude and in frequency

and synchronism of motion (Fig. 3.b). Newton made pendulums having the length of more than 10 m and received the same result of swing synchrony.



a) **b)**

Figure 3: Scheme of motion momentum transfer: a) in Newton pendulum n = 5, b) in an ordinary pendulum.

The second feature of Newton pendulum is that its intermediate elements (balls) do not move, but only transmit its momentum.

Result and Discussion

They were partly proposed in the report [7]. Based on this, a hypothesis was put forward that by picking combining up balls at a length $L = 0.29979 \cdot 10^9\ m$, with a half-period of oscillation of the pendulum $T < 0.5\ s$, it is possible to transfer the impulse of movement to the extreme ball with a speed greater than the speed of light $c = 0.29979 \cdot 10^9\ m/s$ without the movement of intermediate elements. Effect of Einstein's relativistic laws of motion on them is excludes. However, the reality of such an achievement is highly doubtful, because the mass, as a measure of the inertia of the balls, the micro-deformations of their contacting surfaces and the resistance of the environment will not allow such high speeds to be achieved.

Replacing the balls with a rigid rod for motion momentum transfer, even under the conditions of the rod's absolute rigidity (which is technically impossible), does not solve the problems of its inertia, which increases with the increase in the mass and long of the rod.
Thus, to solve the problem, it is necessary to identify a number of main factors hindering the achievement of ultrahigh speeds in systems, such as Newton pendulum.

They are as follows:

1. inertial of mass of the constituent elements;
2. stiffness, strength and deformability of the constituent elements;
3. the presence of voids between the constituent elements;
4. insufficient stiffness connections between the constituent elements.

The air resistance in this case can be neglected, if we assume that the system is located in vacuum, for example, in space (near-earth or more distant), or in a sealed tube without air.

The outlined indicators make it possible to determine the path of further search: - it should be carried out in the sphere of material systems that have close-packed arrangement of components having a minimum mass, the deformation of which, as well as the spaces between them, are excluded.

Therefore, the task of further research is to search for precisely these systems.

Justification of the possibility of solving the task set: within the framework of the principles of a general approach to solving the set problem, the following levels of the material world were

Considered:

1. molecular;
2. atomic;
3. elementary particles.

Since at the level of elementary particles there are problems of their lifetime, conditions of interaction and reproduction in a large number, which it is sufficient to create Newton pendulum of great length, therefore, considering modern possibilities for the development of science and technology, a pendulum based on elementary particles is excluded from further analysis.

The atomic level of the material world is characterized by the creation of either molecules or crystal lattices containing blocks of layers and rows of atoms. Since the lattices have rigid bonds between the layers and rows, this automatically leads to an increase in the inertial mass within the framework block size.

However, instead of the motion of blocks, the speed of momentum transfer in a block may be related to the speed of motion of vacancies, dislocations and twins, which are not considered in detail, since the speed of these processes does not exceed the speed of light in vacuum [4, 8].

It should be noted that in the framework of nanotechnology, it is possible to reduce the blocks of atoms of crystal lattices to single-layer and single-row structures, of graphene type, which reduces their mass. However, this leads to technical difficulties in their formation, which significantly complicates and increases the cost of creating such a pendulum [9].

Further analysis is showed, that the molecular level of the material world, in which the balls of Newton pendulum are reduced to the size of molecules, is the simplest and most accessible for realization. This level is most characteristic of gases and liquids, from which it is advisable to choose those being homogeneous, with the same size of molecules. At the same time, based on the high level of resistance of any molecules to compression and deformation, the last negative factors from the list for their analysis can be eliminated, and intermolecular spaces and their bonds should be considered most influencing the process of momentum transfer.

For molecules in volumes of gases, including those being homogeneous, these bonds are very weak, and the spaces between molecules depend on the following factors [1].

1. external – the environmental conditions (pressure, temperature);
2. internal – eigenstate of molecules (kinetic energy and magnitude of natural oscillations).

Although two external factors and second internal one can be excluded under space conditions of low pressure and temperature,

such a Newton pendulum cannot be reproduced, since gases in space without external volume boundaries will be diluted to a state that significantly reduces the contacts of molecules.

Thus, the molecular level of momentum transfer in volumes of gases, at their density in normal Earth conditions (the pressure of 0.1 *MPa* or 1 technical atmosphere and the temperature of 20°*C*), can be implemented within the speed of sound, which constitutes the value of 340 *m/s*. However, this rate should increase or decrease adequately with increasing or decreasing gas density [1]. The limit is the state of gases before their transition to the liquid state, but at the same time the real momentum transfer speeds usually do not exceed 2 thousand *m/s*, which is one hundred fifty thousand times less than speed of the momentum transfer in electromagnetic fields [1]. Therefore, such molecular systems are not considered in this paper [1].

However, the transition to molecular systems with closed linear-type boundaries still requires analysis.

The implementation of the original example of the analysis – the linear Newton pendulum of the molecular level, as technical solution, is fundamentally possible in capillary systems, for example, using fiber nanotubes having a diameter of D_c, with a diameter of D of contact between them and a gap d of diameter one molecule (Fig. 4).

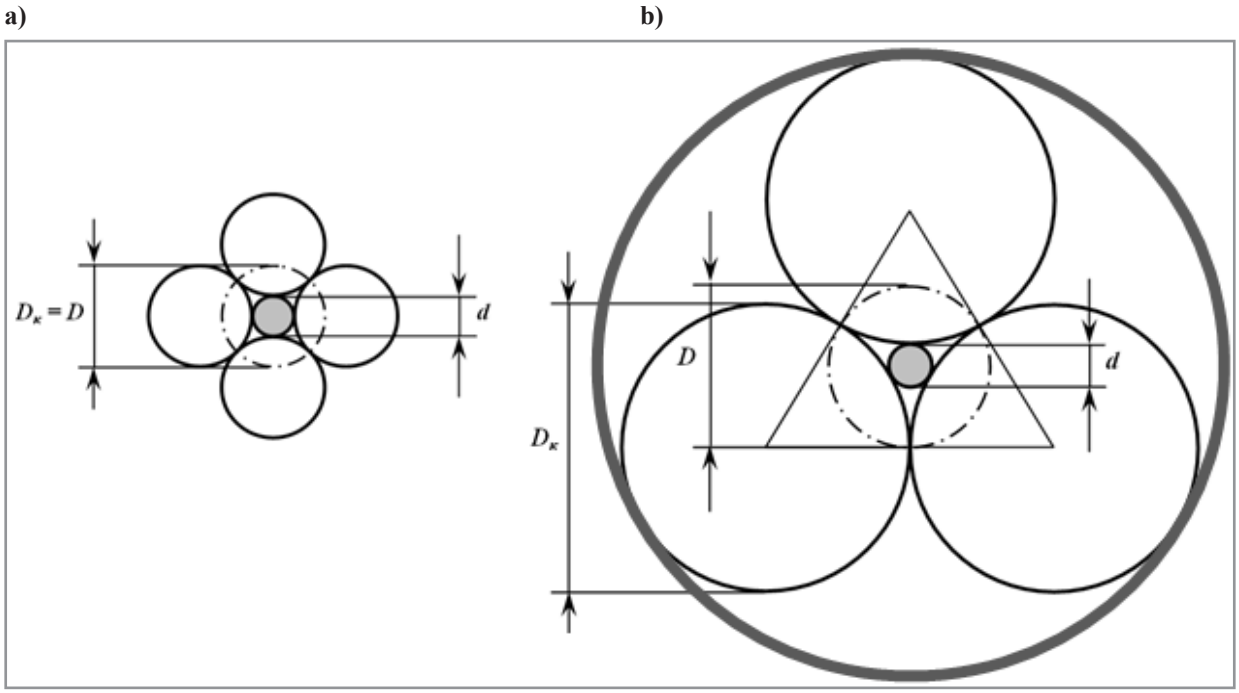


Figure 4: Tubular capillary systems of molecular level: a) – impractical, b)

At the same time, the phenomenon of superfluidity is possible, which is easily achievable for liquid gases at cryogenic temperatures (or in space), and the natural oscillations of molecules and the forces of weak interaction in them will be virtually excluded, which will provide them with a tight package inside the capillary.

Capillary formation is possible with a different number of fibers. However, but the simplest and producible is a capillary with a max diameter of fibers D_c, which is provided by a system of 3 nanotubes shown in fig. 4.b. The relationship of their diameters D_c *and diameters* d of molecules placed between them constitutes the following dependence (4):

$$D_c = \frac{d}{\frac{1}{\sin\left(\frac{180^o}{n}\right)} - 1} = \frac{d}{\frac{1}{\sin\left(\frac{180^o}{3}\right)} - 1} = 6.464d \approx 6.5d. \quad (4)$$

An increase in the diameter of nanotubes by 6.5 times, compared with the diameter of the molecules placed inside them, simplifies their manufacture. Three nanotubes should be placed in a common shell, which ensures their connection and strength. The shell is covered with thermal insulation.

As the working substances of the capillaries, it is preferable to use hydrogen, which has a minimum size and weight of molecule. But this creates problems for the size of nanotubes. Therefore, inert gases cooled to the temperature of cryogenic solidification can be recommended: neon, krypton, xenon. Filling the capillary is possible due to the creation of a vacuum in it and superfluidity of substances at cryogenic temperatures (→0K). At the same time, raising the edges of the capillary (Fig. 5) facilitates the process, and a funnel can be used for pouring.

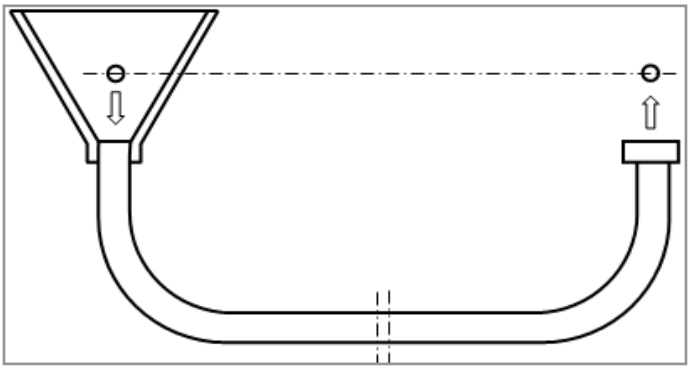


Figure 5: Schemes of filling the capillary with a cryogenic liquid and the movement of molecules in the pendulum.

When the watering can covers the outer surface of the shell, it is possible for the cryogenic liquid to get into the gaps between the nanotubes and the inner side of the shell (Fig. 6.a) and also inside the nanotubes (Fig. 6.b). The rigidity of the system in this case increases. However, she can be used as an additional system cooler.

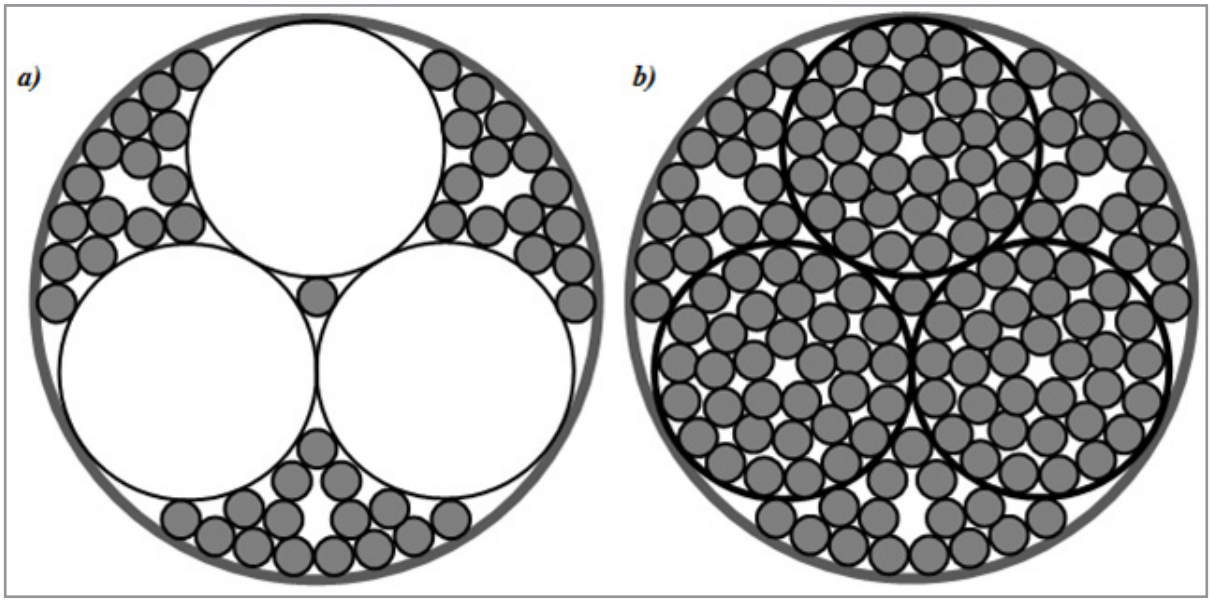


Figure 6: Distribution of Cryogenic liquid in the Shell.

To further increase strength, a system of 3 nanotubes can be placed inside 3 nanotubes of larger diameter D3 (Fig. 7)

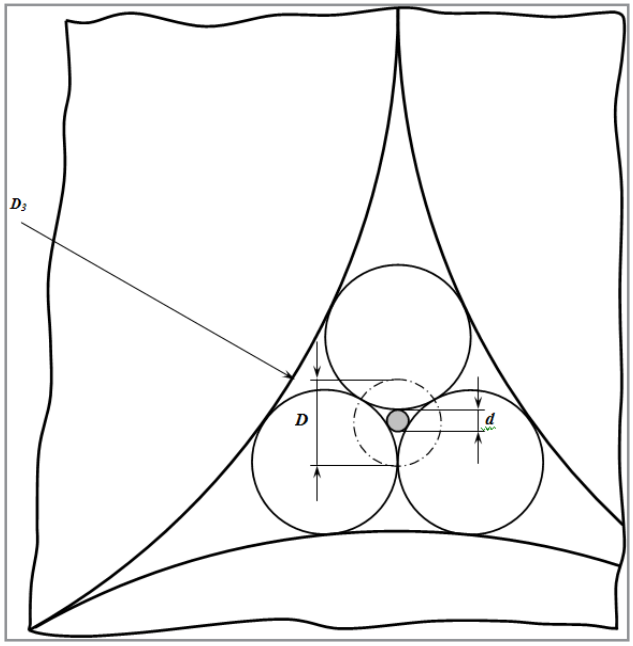


Figure 7: Possibilities for increasing the strength and reliability of a system of 3 nanotubes.

To exclude the release of liquid due to the capillary process, after it appears from the opposite edge of the capillary, his must be blocked, and the filling process must be interrupted. After this exit is unblocked, the capillary process will be indifferent in which direction to move and the state of the liquid in the nanotube will stabilize within the framework of the law of communicating vessels. After that, one molecule of cryogenic liquid should be fed into the inlet edge of the capillary (under free fall or with forced acceleration), which is a technically achievable process under modern conditions. From the opposite end of the pendulum-capillary, a molecule should fly out with the same acceleration. Her departure can also be registered, within the framework of processes technically achievable in modern conditions. It is only necessary to consider the delay in the operation of the equipment for the registration of this process.

The injection of a pulsed molecule must be carried out into the internal gap between nanotubes. In the absence of air resistance for the incoming and outgoing molecule, the process of forward and backward oscillations of the molecular pendulum can be undamped.

The only problem is the technical problem of manufacturing nanotubes of great length (more than a thousand meters). To solve it, it is necessary to create a team of scientists and technicians to develop the project and finance it, with a tender for the manufacture of pipes. Pendulums of capillary type at the molecular level and the technology of their manufacture do not have obvious scientific and technical contradictions. Therefore, they are real in the proposed technical solutions. At the initial stage, it is necessary to make a short model to check the possibility of operation and debugging the operation of systems. Since they have an inventive step, therefore, within the framework of law, they can have the name of its inventor - the Newton-Nastasenko pendulum [10]. In doing so, even at a length of 4 to 8 km, the time difference of the momentum transfer of the molecules of Nastasenko pendulum and the laser beam parallel to it will amount to value (5), which can be determined by modern measuring devices:

$$\Delta t = \frac{1(s)\cdot 4...8\cdot 10^{3}(m)}{0.299792\cdot 10^{9}(m)} = 1.3...2.7\cdot 10^{-6}(s). \quad (5)$$

With increasing measurement accuracy, the length of the capillary system can be reduced to 1 km or less. However, it is also necessary to change the length of the laser system. Considering that it may be simpler than in the LIGO observatory, the implementation of the proposed option may be in the construction of a new observatory.

Thus, the theoretical basis for conducting these experiments and creating a technical system is justified. There are no contradictions with the special and general theory of relativity of Einstein, since the masses of atoms and molecules remain without movement, which makes it possible to begin their realization.

This poses the technical problem of manufacturing nanotubes of great length (more than a thousand meters). To carry out this work, it is necessary to create a team of scientists and technicians for the development of the project and his funding, as well as a tender for the manufacture of nanotubes.

As a basis for the creation of a technical system, laboratories LIGO (fig 8) for identify gravitational waves can be used, which will considerably simplify and reduce the cost of the proposed project [11].

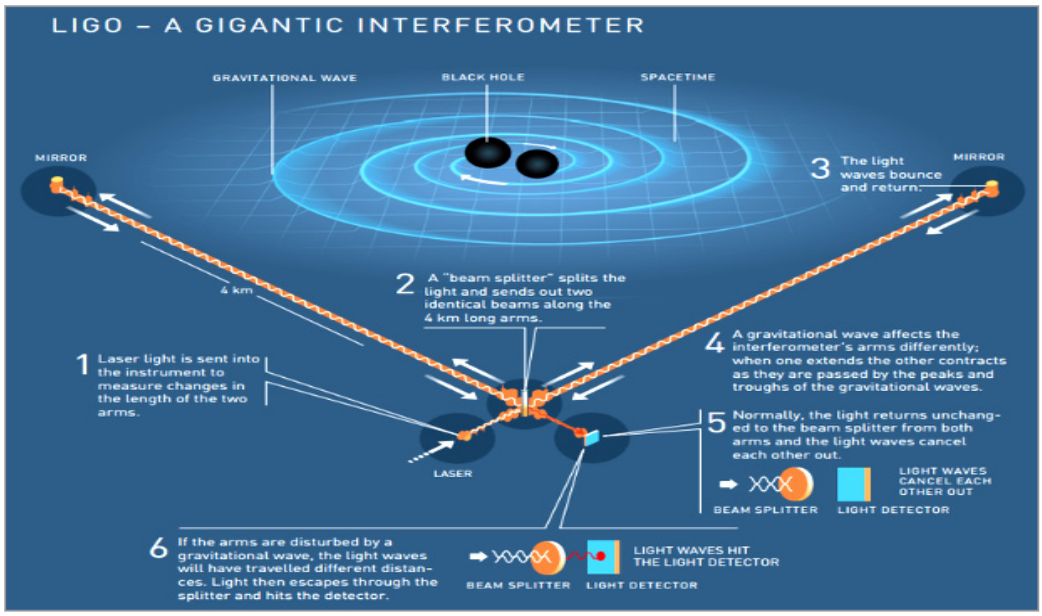


Figure 8: LIGO Measurement scheme [11]

One shoulder can be involved, and in the tunnel for the passage of the laser beam you can lay the proposed tubular cable. In order not to stimulate the capillary process due to the Earth's rotation, it is necessary to use the shoulder that is perpendicular to the direction of its rotation. There are other similar observatories: VIRGO and GEO600 in Europe, a similar type of Kamioka gravitator (KAGRA) operating in Japan, has a LIGO-type observatory in India, which makes it possible to implement the proposed process.

The proposed system is open for further refinement and improvement; therefore, it is submitted for discussion by scientists and the technical community.

It should be noted that even in the absence of confirmation of exceeding the speed of light, Newton's pendulum of the molecular level has the right to life as a new technical solution of inventive step, which proves the feasibility of this publication.

The Newton-Nastasenko pendulum has the 4th (out of 5 existing) level of inventive complexity, since it is very different from the prototype and operates on fundamentally different physical effects [12]. However, it is not patented so as not to impede its creation and research based on it.

General Conclusions

1. Within the framework of the accuracy of the experiments performed, Newton pendulum, made up of several identi-

cal balls tightly adjacent to each other, which are suspended on the threads, provides the possibility of transmission of oscillations and impulses of motion between the extreme balls, synchronously oscillations of the similar he same single pendulum unit. This makes it possible to hypothesize that the speed of light in vacuum can be exceeded when a pulse is transmit-ted by intermediate balls, which can be measured experimentally by means of modern devices with a set of intermediate balls of 4 to 8 km.

2. When the motion momentum is transferred by Newton pendulum, the intermediate balls remain motionless, which excludes the effect of the relativistic laws of mass motion at speeds close to the speed of light.
3. The significant mass of intermediate balls in Newton pendulum, as a measure of their inertia, impedes the achievement of ultrahigh speeds, which requires a transition to pendulums with elements of minimum mass.
4. To minimize the mass of the intermediate elements of Newton pendulum, the simplest and most convenient is the transition to the molecular level of the material world, with the replacement of balls with molecules, preferably from of inert gases, for example xenon.
5. Newton-Nastasenko pendulum of the molecular level can be created on the basis of capillaries from nanotubes assembled in a bundle, tightly adjacent and molecules being linearly introduced into the gap between them. For their contact density and exclusion of natural oscillations, their temperature should be lowered to cryogenic one.
6. A system of 3 nanotubes is advantageous in terms of the ratio of their sizes and the molecules introduced into the space between them.
7. When manufacturing long nanotubes, there are no technical obstacles to the experiment.
8. The research base can be the LIGO laboratory, which will reduce the time and money spent on preparing and executing work.
9. For realization this project requires the creation of a team of scientists and technicians and funding of their work.
10. The totality of the presented information indicates the possibility of the proposed research and the need to create a team with the necessity of raising funds to carry it out, which is proposed to be discussed at this paper.

Conflict of Interest, Acknowledgments and Thankfulness'

The proposed work was carried out by the author independently as a personal initiative, based on personal scientific papers and literary sources open to the public [7].

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