Space vs. Vacuum: Facts Show That Space Isn't a Vacuum

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Below are listed eight facts which indicate that outer space is not a empty vacuum. These eight different phenomena of nature all give evidence that leads one to doubt that the outer space surrounding us a true vacuum.

1. Space has temperature, and a vacuum by the nature not can have temperature.
2. In space there are the whirlwinds, one of which our Galaxy (Milky Way). Whirlwinds on the Earth in water and in the atmosphere have been well known (Cyclones, anticyclones, hurricanes). And for a long time whirlwinds have been known in Jupiter's atmosphere. Whirlwinds in Saturn's atmosphere and Neptune's atmosphere have been found recently, whirlwinds on the Sun are also known. In a vacuum there are no whirlwinds as far we know.
3. A viscous liquid has convection cells, for the first time described by B.H. Benard and John William Strutt, and 3rd Baron Rayleigh. Such cells are well-known to be much like honeycombs. These convection cells, whose parameters depend on the criterion of validity of John William Strutt, 3rd Baron Rayleigh and Ludwig Prandtl have been repeatedly observed in laboratories for a variety of liquids of various degrees of viscosity. Huge cells, outwardly similar to huge honeycombs have been found out on The North Pole of Saturn in 2007 and on the South Pole of Saturn in 2009. The least diameter of such honeycombs is approximately 25,000 kilometers. Considerably larger cells having also the form of honeycombs have been found for the first time by the Estonian astrophysicist Jaan Ejnasto in 1968. The defining size of these cells is nearly 100 - 200 Mpc. And this one additionally strongly indicates that space is a definite environment, but not a vacuum.
4. In addition to liquids and gases, space contains various emptynesses and these mptinesses are of the order 10-30 Mpc., Voids, and the larger of order 150-200 Mpc., Supervoids. In 2008 an emptiness whose size attained 3000 Mpc. has been found.
5. In 2009 in space solitons have been found . It is ell-known that solitons exist in liquids, in the atmosphere of the Earth, in optical materials and finally also in space.
6. In water and air, the well-known phenomenon of the attached weight exists. A similar phenomenon is observed in accelerators in which a vacuum is almost realized.
7. In 2010 it was shown that the hydraulic jump-phenomenon, which occurs in the bottom bief of dams, is a good physical model of a white hole. This term names a certain area through which nothing passes. White holes have not found yet experimentally in outer space, however their existence is postulated certain physical hypotheses. This is one more analogy between liquid and space.
8. In 2010 it was discovered that the biggest ring of Saturn – through which pass huge waves even more similar to the huge waves arising in space and determining the spiral structure of galaxies.

1. Introduction

Certain of these phenomena are discussed in more detail in a monograph by A. V. Rykov [6]. There is an English translation of this book. We note that one of the above listed facts speaks of the phenomenon which began to be discussed soon after the writing of this monograph. Above we have noted that many professionals and interested people having a huge interest in these matters have viewed on the Internet these unusual photos taken from onboard the spaceship Cassini in 2007 and 2009. They found huge true hexagons on the northern and southern poles of the planet. In April 2010, the physicists Ana Claudia Barbosa Aguiar and Peter Read from Oxford University in Britain, observed a similar kind of a hexagon in their laboratories. But there was even earlier a hexagon on Northern Pole of Saturn found early in 1978 during the flight the Voyager. At the time, the unusual form was written off as a nearby storm in the atmosphere of Saturn. New results, in particular that a hexagon has been photographed by Cassini in high resolution and also without a storm nearby furnished reason to believe that hexagon formation was caused by hydrodynamic effects in the atmosphere of Saturn. In the seventies of the 20th century the Estonian astrophysicist Y. Einasto together with M. Yivaar and Togo has shown that congestion Galaxies tend to be grouped into thin, extended formations, called a congestion of galaxies which being joined and branching form in space cellular structures. By the end of 20 century the research of the Estonian astrophysicists Y. Einasto, M.Yivaar, A. Saar and the American astrophysicists P. Pibls, O. Gregory and L. Tompson have shown that the most large-scale heterogeneity in distribution of galaxies has a cellular character.

In the boundaries, these cells, galaxies, and their congestions are found, but inside emptiness are concentrated. The sizes of the cells are 100-200 Mpc, the thickness of the boundaries of the cells is 3-4 Mpc. That in space such cells are found testifies in favor of these being there.

Certain effects similar to the hydrodynamic effects take place in the atmosphere of Saturn. In July, 2009 a member of the staff of UNESCO, Paris Y. Einasto, received the Marseilles Grassman award for their foundational contributions in the description of the cellular structure of the Universe. In that organization, he has originated the idea that the presence of such effects is caused by outer space not being a vacuum, but being filled by a dark substance. There are now no answers to questions: what is the dark substance and why it has not been discovered until now (March 2011)? There are only hypotheses.

As a result of numerous assumptions, there is an opinion which divides physicists, and the author can become mixed up with neutrino theory. In order to approach the resolution of this question, we will consider the theory of convection cells in the light of the evidence contained in the works stated in/1-5/. In that place, this approach is referenced in the extensive bibliography concerning this question.

Organized research concerning convection movements in a horizontal liquid layer begins with Benard's works in 1900. In originating the explanation of the occurrence a pole in of the six-coal cellular structures similar on honeycombs, Benard analyzed a role of viscosity of a liquid and superficial tension.

In the first theoretical research concerned the problem of the occurrence of convection in a horizontal layer of a liquid, Rayleigh investigated the case of two free borders in 1916. He has established that the transition from a heat conductivity mode (thermo diffusion or a conduction) to mode convection in a horizontal layer of a liquid of a finite thickness, when warmed from below, occurs at some critical value.

This dimensionless constant was named subsequently the number of Rayleigh and can be given as

$$Ra = \frac{\alpha\, g\, \Delta t\, d^3}{\nu\, a}, \tag{1}$$

In this paper, the symbol $[\;]$ will designate the dimension of the quantity specified inside the brackets. The standard abbreviations m for meters and gr for temperature gradient will be used.

$\alpha =$ Liquid volume expansion factor, $[\alpha] = \mathrm{gr}^{-1}$.

$g =$ Gravity acceleration, $[g] = \mathrm{m/sec}^2$, on Earth $9.81\,\mathrm{m/sec}^2$.

$\Delta t =$ Temperature difference between the bottom and top surface of a layer, $[\Delta t] = \mathrm{gr}$.

$d =$ Thickness of a horizontal layer, $[d] = \mathrm{m}$.

$\nu =$ Kinematic viscosity of a liquid, $[\nu] = \mathrm{m^2/sec}$.

$a =$ Thermal diffusivity of liquid heat conduction, $[a] = \mathrm{m^2/sec}$.

The relation of the last two parameters

$$\mathrm{Pr} = \frac{\nu}{a} \tag{2}$$

is called the criterion of Prandtl for the given environment. Rayleigh has constructed a theory of convection cells in a liquid layer, ignoring the phenomenon of the superficial tension in a liquid. The necessity of the consideration of a gradient superficial tension has originally resulted from (M. J. Block's) work. He has shown that cellular convection exists in a horizontal layer.

This can occur when the temperature gradient is 10 times. This is less, than it is required under the theory of Rayleigh. As a result of M. J. Block's work we have come to the conclusion that the cells of Bernard observed in experiments, were formed as a result of a change of superficial tension, which it is caused by non-uniformity of temperature on a liquid's free surface.

$\sigma =$ Tangential force on area unit surfaces, $[\sigma] = \mathrm{N/m^2} = \mathrm{Pa}$.

$V_x, V_y, V_z =$ Projections of liquid velocity, $[V] = \mathrm{m/sec}$.

$\eta =$ Hydrodynamic factor viscosity, $[\eta] = \mathrm{N\text{-}sec/m^3}$.

Then concerning the conditions in a free surface at $V_z = 0$, we can write

$$\eta \frac{\partial V_x}{\partial z} = \frac{\partial \sigma}{\partial x}, \quad \eta \frac{\partial V_y}{\partial z} = \frac{\partial \sigma}{\partial y}. \tag{3}$$

Using the equation of divergence of liquid

$$\frac{\partial V_x}{\partial x} + \frac{\partial V_y}{\partial y} + \frac{\partial V_z}{\partial z} = 0, \tag{4}$$

And differentiating first Eq. (3) with respect to x and then secondly with respect to y, we obtain

$$\eta \frac{\partial^2 V_z}{\partial z^2} = -\left(\frac{\partial^2 \sigma}{\partial x^2} + \frac{\partial^2 \sigma}{\partial y^2}\right). \tag{5}$$

According to [1], the superficial tension it is linearly connected with temperature, and consequently

$$\sigma(t) = \sigma_0 - \gamma t, \tag{6}$$

where $\gamma = -\dfrac{\partial \sigma}{\partial t}$ – is the temperature factor of the superficial tension.

$[t] = \mathrm{grad}(gr)$ $\quad [\gamma] = \dfrac{N}{m^2 gr}$. Then from (5) we will obtain

$$\eta \frac{\partial^2 V_z}{\partial z^2} = \gamma \left(\frac{\partial^2 t}{\partial x^2} + \frac{\partial^2 t}{\partial y^2}\right) \tag{7}$$

Such parity has been observed by F. A. Garifullinym [1]. It is impossible to call Eq. (7) a formal equation because this equality includes two unknown functions $t(x, y, z)$ and $V_z(x, y, z)$ involved in this equality.

We will show further, how in our opinion, it is possible to add to it, and to further to solve it. We have already mentioned above that the true hexagon is the most widespread form of stationary convection cells. And concerning them, we now will terminate our discussion. The defining the size of such cells is their diameter. For example, the horizontal diameter of a honeycomb cell made of wax, is nearly 5.3-5.7мм.

If made from this material by a drone, such a cell is approximately 1.5 times larger. The similar size of a cell in soap water was described by James Thomson in 1888. I have already discussed the sizes of convection cells in the atmosphere of Saturn and in the large-scale structures of the Universe.

So our problem consists in this: to introduce the equality (7) and on the basis of it to construct an algorithm, allowing us to find the defining sizes of convection cells *R*.

Knowing the radial size of a cell, it is possible to observe the configuration of a cell, which will look like a true hexagon. It is possible to write this hexagon in Cartesian coordinates as

$$y^2 = 3(R+x)^2 \text{ at } -R \le x \le -\frac{R}{2}$$

$$y^2 = \frac{3}{4}R^2 \text{ at } -\frac{R}{2} \le x \le \frac{R}{2} \tag{8}$$

$$y^2 = 3(R-x)^2 \text{ at } -\frac{R}{2} \le x \le R$$

Let's return to the definition of the size of convection cells; to begin with let's convert Eq. (7) to cylindrical coordinates, and then we will consider the idle time case, it being an initial problem which is axially symmetrical. Then instead of (7), we have

$$\eta \frac{\partial^2 V_z}{\partial z^2} = \gamma\left(\frac{\partial^2 t}{\partial r^2} + \frac{1}{r}\frac{\partial t}{\partial r}\right); \quad 0 \le z \le d; \; 0 < r < \infty . \tag{9}$$

r = radial coordinate $[r] = m$.

d = vertical thickness layer in which occurs convection.

V_z = vertical projection of speed stream of a liquid.

$V_z = V_z(r,z)$ dimension is already known.

t = axial symmetrical temperature in the specified layer of a liquid $t = t(r,z)$.

The stationary temperature field in such layer of a liquid satisfies the following equation.

$$V_z \frac{\partial t}{\partial z} = a\left(\frac{\partial^2 t}{\partial r^2} + \frac{1}{r}\frac{\partial t}{\partial r}\right); \quad 0 \le z \le d; \; 0 < r < \infty . \tag{10}$$

Here one assumes that it is in the vertical that convective heat transfer is carried out, and this convection is in the radial direction, and it is characterized by the factor known as the thermal diffusion *a*.

As a result, we have obtained a system of two equations in partial derivatives, from which basically it is possible to find two unknown functional solutions which satisfy the known conditions on boundaries of the area, which can be written down as

$$t(r,0) = t_1; \quad 0 < r < \infty . \tag{11}$$

Here $t_1 = \text{const}$ is the so-called temperature of input. We will consider it constant. As Eq. (10) includes the first derivative with respect to the vertical co-ordinate, it is possible to specify only one condition on the bottom surfaces of a layer $z = 0$, the temperature on a free surface of a layer $z = d$, should be obtained in the course of the solution of the system of the Eqs. (9, 10).

Upon approaching infinity, the temperature and the temperature gradient fade and consequently let's set

$$\lim_{r\to\infty} t(r,z) = \lim_{r\to\infty} \frac{\partial t}{\partial r}(r,z) = 0; \quad 0 < z < d \tag{12}$$

And these conditions will be enough to find distribution of temperatures in the investigated layer. We approach the solution of this problem through the use of a method of consecutive approximations. As a first approximation in Eq. (10) it is assumed that $V_z(r,z) = V_0 = \text{const}$, as then Eq. (10) with boundary conditions (11) and (12) determine the analytical method. Actually, following [7], let's apply to the equation

$$V_0 \frac{\partial t}{\partial z} = a\left(\frac{\partial^2 t}{\partial r^2} + \frac{1}{r}\frac{\partial t}{\partial r}\right); \quad 0 \le z \le d; \quad 0 < r < \infty \tag{13}$$

the transformation of Hankel

$$\bar{u}(\xi) = \int_0^\infty r\, u(r) J_0(\xi r)\, dr \tag{14}$$

with the associated equation

$$u(r) = \int_0^\infty \xi \bar{u}(\xi) J_0(\xi r)\, d\xi \tag{15}$$

Further we will magnify both members of Eq. (13) by a factor $r J_0(\xi r)$ and we will integrate over *r* with limits from 0 to ∞. As a result, the left side of (13) $V_0 \frac{dt(\xi,z)}{dz}$ will be transformed to the same kind, and the right side of (13) $a\int_0^\infty \left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial t}{\partial r}\right)\right) r J_0(\xi r)\, dr$ will be displayed so we can integrate it once by parts. As a result we have

$$\begin{aligned} &a\int_0^\infty \left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial t}{\partial r}\right)\right) r J_0(\xi r)\, dr \\ &= a r \frac{\partial t}{\partial r} J_0(\xi r) I_0^\infty - a\int_0^\infty r \frac{\partial t}{\partial r}\frac{d J_0(\xi r)}{dr}\, dr \end{aligned} \tag{16}$$

Here I_0^∞, put after expression means that in $ar\frac{\partial t}{\partial r} J_0(\xi r)$ this expression should be substituted into first using $r = \infty$ and then substituted into using $r = 0$, and further the second obtained expression should be subtracted from the first to evaluate this definite integral.

Using the second of the boundary conditions (12) to find the integral of the right side of (16), once again we will apply integration by parts. And then using the first of the boundary conditions (12), $a r \frac{\partial t}{\partial r} J_0(\xi r) I_0^\infty = 0$, we will obtain

$$\begin{aligned} &a\int_0^\infty \left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial t}{\partial r}\right)\right) r J_0(\xi r)\, dr \\ &= -a r t \frac{d J_0(\xi r)}{dr} I_0^\infty + a\int_0^\infty t \frac{d}{dr}\left(r\frac{d J_0(\xi r)}{dr}\right) dr \end{aligned}$$

Here in the integral on the right, we substitute for this integral from the equation:

$$a\int_0^\infty\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial t}{\partial r}\right)\right)rJ_0(\xi r)dr$$

$$=a\int_0^\infty tr\left(\frac{1}{r}\frac{dJ_0(\xi r)}{dr}+\frac{d^2J_0(\xi r)}{dr^2}+\xi^2J_0(\xi r)-\xi^2J_0(\xi r)\right)dr$$

This includes the same expression $\xi^2J_0(\xi r)$, but $J_0(\xi r)$ is Bessel's function of zero order, and consequently

$$\frac{d^2J_0(\xi r)}{dr^2}+\frac{1}{r}\frac{dJ_0(\xi r)}{dr}+\xi^2J_0(\xi r)=0$$

$$a\int_0^\infty\left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\frac{\partial t}{\partial r}\right)\right)rJ_0(\xi r)dr=-a\xi^2\overline{t}(\xi) \tag{17}$$

and using this result Eq. (13) will be transformed to the form

$$V_0\frac{d\overline{t}}{dz}=-a\xi^2\overline{t}$$

whose solution is obvious.

$$\overline{t}=C_1\exp\left(-\frac{a}{V_0}\xi^2z\right) \tag{18}$$

The constant C_1 we will be determined by the boundary condition (11). Then we have

$$\overline{t}=t_1\exp\left(-\frac{a}{V_0}\xi^2z\right)\int_0^\infty rJ_0(\xi r)dr \tag{19}$$

And, using the reference equation, we will find

$$t(r,z)=t_1\int_0^\infty\xi\exp\left(-\frac{a}{V_0}\xi^2z\right)\left(\int_0^\infty rJ_0(\xi r)dr\right)J_0(\xi r)d\xi \tag{20}$$

According to (9) and (13) we write

$$\eta\frac{\partial^2V_z}{\partial z^2}=\gamma\frac{V_0}{a}\frac{\partial t}{\partial z}, \tag{21}$$

$$\frac{\partial t}{\partial z}=-t_1\frac{a}{V_0}\int_0^\infty\xi^3\exp\left(-\frac{a}{V_0}\xi^2z\right)\left(\int_0^\infty rJ_0(\xi r)dr\right)J_0(\xi r)d\xi, \tag{22}$$

For V_z, we will write down following boundary conditions: the first

$$V_z(r,0)=V_0 \tag{23}$$

means that on the bottom surface convection the stream has constant speed. And the second

$$V_z(r,d)=0 \tag{24}$$

means that on a free surface the $z=d$ and the vertical component of the convection a stream vanishes. In satisfying these conditions, we will arrive at a first approximation. The distribution of the speeds in the investigated layer is given by

$$V_z(z,r)=t_1\frac{\gamma}{\eta}\frac{V_0^2}{a^2}\int_0^\infty\frac{1}{\xi}\exp\left(-\frac{a}{V_0}\xi^2z\right)\int_0^\infty rJ_0(\xi r)dr\,J_0(\xi r)d\xi \tag{25}$$
$$+D_1z+D_2$$

where

$$D_1=-\frac{V_0}{d}+t_1\frac{\gamma V_0^2}{\eta a^2d}\int_0^\infty\frac{1}{\xi}\left(1-\exp\left(-\frac{a}{V_0}\xi^2d\right)\right)\left(\int_0^\infty rJ_0(\xi r)dr\right)J_0(\xi r)d\xi \tag{26}$$

$$D_2=V_0-t_1\frac{\gamma V_0^2}{\eta a^2}\int_0^\infty\frac{1}{\xi}\left(\int_0^\infty rJ_0(\xi r)dr\right)J_0(\xi r)d\xi. \tag{27}$$

The convection cells' radii will be found from the condition that the radial component of a convection stream on the external border of this cell. At it is, if $r=R$, this vanishes, that is,

$$V_r(R,z)=0. \tag{28}$$

The radial component of a convection stream will be found from the condition that the divergence, written down in cylindrical co-ordinates is

$$\frac{1}{r}\frac{\partial}{\partial r}(rV_r)+\frac{\partial V_z}{\partial z}=0, \tag{29}$$

where $\frac{\partial V_z}{\partial z}$ is already known to be

$$\frac{\partial V_z}{\partial z}=D_1-t_1\frac{\gamma V_0}{\eta a}\int_0^\infty\xi\exp\left(-\frac{a}{V_0}\xi^2z\right)\left(\int_0^\infty rJ_0(\xi r)dr\right)J_0(\xi r)d\xi. \tag{30}$$

The last expression is not to conflict with the subsequent statement.

Let's assume $f(z,r)$ and the transcendental equation interesting us, from which basically it will be possible to find the size of a cell, can be written as

$$\int_0^R rf(r,z)dr=0. \tag{31}$$

The solution of such a transcendental equation can be unique or not, and it reflects that fact that one or several cells will possess the same axis of symmetry as the basic cell. Also this will take place in each of the subsequent cells. This is visible, for example, in photos received by the probe Cassini.

I will remind the reader that this only the first approximation. Actually, having obtained the temperature distribution in a layer from expression (20), it is necessary to substitute it, not into (13), but into (10), and to re-obtain a new distribution of speeds, which then again is substituted into the equation (7) and so on. And such a problem can be only solved numerically. The obtained first approximation can be iterated so as to compute the result accurately enough by means of the writing of special programs for the computer. Such programs will allow us to estimate the sizes of cells, knowing all the initial parameters. It will allow us to test these programs, comparing their results to the data from the experiments stated [2-5]. And then it is possible to begin to solve the following problem: knowing the sizes of convection cells in the atmosphere of Saturn and in Space, then to (probably) estimate the initial parameters of the environment: the viscosity, the thermal diffusivity, the factor of the superficial tension, the temperature convection of a stream, the initial speed of a convection stream, and the thickness of a convection layer. The parameters of the atmosphere of Saturn (probably) will be possible to estimate in advance, and the parameters of the dark matter will be possible, most likely, to find only in such a way.

In addition, we will return once again to numerical realization of the first approach. The cruz of the matter is that the Eq. (20) and the subsequent equations contain the integral

$$\int_0^\infty r J_0(\xi r)\,dr ,$$

which following [8, p. 698, № 14], is equal here to $\frac{2}{\xi^2\Gamma(0)}$; in the denominator there is a gamma function evaluated at zero which at this point contains a singularity that complicates the further use of this expression. But it is possible to considerably simplify the Eq. (20) and the subsequent equations, if one assumes that

$$t(r,0)=\frac{t_1\beta}{\sqrt{r^2+\delta^2}} \qquad (32)$$

where β and δ are some parameters, $[\beta]=m$ and $[\delta]=m$. This means that the temperature on the bottom surface is not constant, and a local variation of temperature takes place.. After being heated, the situation is closer to the physical picture of the phenomenon being considered.

According to [8, p. 696, № 6.554], we have

$$\int_0^\infty \frac{r J_0(\xi r)dr}{\sqrt{r^2+\delta^2}}=\frac{1}{\xi}\exp(-\delta\xi),\ \xi>0,\delta>0 .$$

And the Eq. (20) will be transformed into the form

$$t(r,z)=t_1\beta\int_0^\infty \exp(-\frac{a}{V_0}\xi^2 z)\exp(-\delta\xi)J_0(\xi r)d\xi , \qquad (33)$$

which is much more elementary than (20). And the Eq. (30) will become

$$\frac{\partial V_z}{\partial z}=D_1-t_1\beta\frac{\gamma V_0}{\eta a}\int_0^\infty \exp(-\frac{a}{V_0}\xi^2 z)\exp(-\delta\xi)J_0(\xi r)d\xi$$

where

$$D_1=-\frac{V_0}{d}+t_1\beta\frac{\gamma V_0^2}{\eta a^2 d}\int_0^\infty \frac{1}{\xi^2}\left(1-\exp\left(-\frac{a}{V_0}\xi^2 d\right)\right)\exp(-\delta\xi)J_0(\xi r)d\xi \qquad (34)$$

From the equation of indissolubly and from the condition that, on the external border cells, the radial component of the convection stream is equal to zero, we have

$$V_r(R,d)=-\frac{1}{R}\int_0^R r\frac{\partial V_z}{\partial z}(r,d)dr=0 \qquad (35)$$

where R is the radial size of the convection cells.

According to [8, p. 648, № 5.56], the last integral is possible to be expressed in the form of analytical dependence and consequently we will have a transcendental equation from which basically it is possible to obtain

$$t_1\beta\frac{\gamma V_0}{\eta a^2}R\int_0^\infty \frac{1}{\theta^3}(1-\exp(-\frac{a}{V_0}\theta^2\frac{d}{R^2}))\exp(-\frac{\delta}{R}\theta)J_1(\theta)d\theta$$
$$-t_1\beta\frac{\gamma d}{\eta aR}\int_0^\infty \frac{1}{\theta}\exp(-\frac{a}{V_0}\theta^2\frac{d}{R^2})\exp(-\frac{\delta}{R}\theta)J_1(\theta)d\theta=\frac{1}{2} \qquad (36)$$

The radial size of the convection cells R is unknown to us. In Eq. (36), θ is a dimensionless variable of integration.

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