The old and new Concepts of Physics
An open-dialogue journal
www.uni.lodz.pl/concepts

DESCARTES' VACUUM IN HOLE GRAVITATION THEORY

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(Received 31 March 2009; accepted 1 September 2009)

Abstract

Intuitively, a vacuum is what is left when all matter (invisible as well as visible) is removed from a region. In this paper it is shown that depending on the speed we remove the matter, we can obtain a Torricelli' vacuum or a Descartes' absolute vacuum (a hole in space-time). The advantage of the Descartes' vacuum is that it can easily explain the gravitational attraction and the curvature of space-time using the properties of holes only. According to the theory, matter radiates a flux of holes, which curve space-time and this curvature influences the movement of matter. The hole version of universal gravitation law has been formulated. Mass is the parameter describing the ability of a particle to emit out holes, the more holes particle emits, the more the mass.

1 Introduction

Understanding the nature of mass is crucial in fundamental research. Since attempts to detect the Higgs boson, and therefore to verify the Higgs field as the mass-generating mechanism of the Standard Model, have been unsuccessful, paper proposes a very simple model of gravitation that use the Descartes' void (holes in space-time). The advantage of the present approach is that it can easily explain the curvature of space-time using the properties of Descartes' vacuum only. Gravitation is a phenomenon by which all objects with mass attract each other. Hole theory of gravitation explains why object have mass, how all objects with mass attract each other. Matter interacts with space-time that and radiates a flux of holes that is the cause of the gravitation. Thus for explanation of gravitation the present theory use the hole structure of space-time only.

2 Holes in space-time

Descartes maintained that there could be no vacuum, and all matter was constantly swirling to prevent a void as corpuscles moved through other matter. Nevertheless, Descartes first describes the new type of absolute void. Let's analyze the main ideas in Descartes theory [1]: "if it be asked what would happen were God to remove from a vessel all the body contained in it, without permitting another body to occupy its place, the answer must be that the sides of the vessel would thus come into proximity with each other. For two bodies must touch each other when there is nothing between them, and it is manifestly contradictory for two bodies to be apart, in other words, that there should be a distance between them, and this distance yet be nothing; for all distance is a mode of extension, and cannot therefore exist without an extended substance". Thus the main positions of Descartes theory [2] are: 1. If to remove from a vessel all the body contained in it, without permitting another body to occupy its place, the sides of the vessel would thus come into proximity with each other; 2. All matter was constantly swirling to prevent a void; 3. it being absolutely contradictory that "nothing" should possess extension. It means that the absolute Descartes vacuum do not have the property of extension. It is important to notice that in modern physics the concept of space-time combines space and time within

a single coordinate system. In the Theory of Relativity, time is no more an independent physical quantity, it is linked with space in four-dimensional space-time. Consequently, inside of Descartes vessel is no extension and no time too, it is a hole in space-time. In such a way a hole in metal, for example, do not have the properties of metal. Probable, Descartes does not mention about time in his vessel because in past physical time was an independent quantity (absolute time), running uniformly throughout the entire cosmic. Let we repeat the Descartes experiment with vacuum. There is a vessel contained a gas (body). Consider a gas has been completely evacuated by pumps and other devises, so that the (classical) particle concentration is zero. According to Descartes, the sides of the vessel would thus come into proximity with each other. Nevertheless, we see the vessel intact, in spite of the fact that a vessel contains a vacuum. According to Descartes, "nothing cannot possess extension"; consequently, our vessel is not empty and contains invisible particles. It means another "body" (or particles) occupied the vessel's space during a time we evacuate a gas. It explains why the walls of the vessel do not come into proximity with each other. What particles fill our "empty" vessel? These particles are able to penetrate through any material walls, and could not be removed neither by the pumps, nor by other similar devices. Particles are invisible, but possessing the property of extension. Probably it is neutrino, fundamental fields, radiation or virtual pairs particle-antiparticle which are present in the vacuum. Besides some theories affirm that space is quantized and consist of elementary volumes dV or space cells. The space cells have just the property of extension, are invisible and cannot be removed from vessel neither by pumps nor by other similar devises. Thus, the conclusion is that during time we evacuate a gas from vessel, the free space occupies another particles. But even so, the main question remains unresolved about if there could be the Descartes' void in our chamber. How can we create a Descartes' vacuum? We must remove from a vessel all the body contained in it, without permitting another body to occupy its place.

There is a solution to use Einstein's relativity to produce holes; no signal can be transmitted faster than **c**. Since the speed of motion is limited by the speed of light **c**, if we remove the body from vessel very quickly (instantly), the sides of the vessel would thus come

into proximity with each other, because environment cannot occupy the vessel's space instantly. Because the walls of vessel are material and cannot move faster than light in order to come into proximity instantly. Therefore the lifetime of Descartes void or a hole in space-time is nonzero.

There are two kinds of the physical vacuum: a Torricelli' vacuum and a Descartes' vacuum. First we obtain if the body is removed slowly from the vessel due to the space of vessel occupies quickly other particles; Second absolute void we obtain if we remove the body instantly. In this case the Descartes void exist during a short time while walls of the vessel come into proximity with each other at near-light speeds. In other words, a Torricelli' vacuum is a volume of space that is essentially empty of matter, such that its gaseous pressure is much less than atmospheric pressure. In contrast, a Descartes' vacuum is a total absence of both matter and space-time (in vessel) due to the walls of vessel come into proximity with each other. The Descartes vacuum (a hole in space-time) can be directly deduced also from the theory of quantized vacuum. Lets analyze the implications of quantized space-time - space being granular, not continuous, at its smallest scales. Suppose that space-time is composed of a fluctuating space cells or space atoms (elementary volumes dV). Such particles are invisible and Lorenz invariant because they are virtual particles that appear and disappear continuously. If the space cell disappears (instantly), in the same "place" appears a vacant place or a hole in space-time. Then particles of surrounding medium (space cells and elementary particles) fill a hole as a Descartes' vessel. In that case the virtual holes and "Descartes' vessels" must fill the entire Universe, if the space-time has quantum structure. It is enough to construct the present Hole Gravitation theory. If one space cell disappears with creation of hole, the surrounding particles fill the hole as show figure 1. According to Descartes, such holes must have the following properties:

1. Descartes theory affirms that a hole in space-time cannot have the extension properties, because "it being absolutely contradictory that nothing should possess extension" [1]. In addition, it is logically evident that a hole in space-time cannot have also the time properties, because it is a hole in space-time. More precisely, the properties of extension and time of hole tends to zero. Very close to a hole, time

virtually stands still for the outside observer.

2. Therefore, we cannot observe a hole by definition, because "it is nothing", but we can observe the Descartes vessel - the material walls of vessel that would thus come into proximity with each other;

3. The lifetime of the hole is nonzero because surrounding particles (the walls of vessel) cannot come into proximity with each other instantly (because the speed of motion is limited by the speed of light c). Therefore the lifetime of hole cannot be less than R/c. (R is the radius of hole, **c** - the speed of light).

3 Hole gravitation theory

Thus, space-time is quantized and consists of fluctuating space cells dV which appear and disappear continuously. When space cell disappears, instead appears a hole in space-time. Therefore, the holes in space-time appear continuously in random points. We analyze interaction of a material particle P with the vacuum holes.

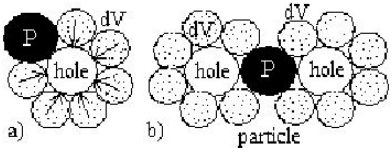

Figure 1: The interaction of particle P with one (a) and two holes (b). It is a Descartes vessel with a hole in the centre (the white spheres), walls composed of material particle P (black sphere), and space cells (grey spheres).

Around particle P continuously appear and disappear holes in space-time. Consider the interaction between a particle P and a vacuum hole (Figure 1a). The appearance of the vacuum hole near P means that a Descartes void has appeared which must be filled by all surrounding particles (by particle P and surrounding space cells dV). In fact, it is a Descartes vessel, where white spheres are the vacuum holes and grey spheres are the walls of vessel. Therefore a particle P and space cells dV will move to the centre of hole. Let's

consider now a case when two vacuum holes appear simultaneously on opposite sides of particle, as show figure 1b. The particle cannot fill simultaneously two holes and cannot move to the opposite sides; therefore particle will stand fixed while both vacuum holes will be filled by surrounding space cells (dV) only. Since the dV moves to particle, it means that the holes move to the opposite side. There is analogue with an electric current where electrons move in one direction and holes move in the opposite. As vacuum holes continuously appear around particle, it means that particle will emit continuously a flux of "their own" holes. It is necessary to notice, that dV moves to particle in both cases *a* and *b* (Figure 1). Therefore, particle radiates holes in both cases *a* and *b*. Thus, a massive material body must emit a flux of holes by each component particle. The speed of motion of vacuum hole in space should be equal to the "collapse" speed of hole that is supposed to be equal to the speed of light c. The definition of mass: The mass of a particle is a parameter describing the ability of a particle to interact with vacuum holes and emit "its own" holes; the more holes a particle radiates, the more the mass.

4 The hole version of universal gravitation law

If to collect all holes emitted by a material point during a time unit (one second), we shall receive a sphere with volume V and radius r. In that case the definition of universal gravitation can be formulated in the following manner: There is a force of mutual attraction between two points directly proportional to cubes of radiuses of summarized volumes of holes emitted in time unit and inversely proportional to square of distance between them. If the two bodies emits during a second a volume of holes V_1 and V_2, with radiuses r_1 and r_2, and the distance between them is R, the magnitude of the force is:

$$F = G_m \frac{r_1^3 r_2^3}{R^2} \tag{1}$$

Where G_m is a metric gravitational constant equal to $Gm = 1,665 * 10^9 N/m^4$ (or $kg/m^3 s^2$); R is the distance between two points that emits holes (or between the centers of mass of interacting bodies); If bodies are small compared with the distance R, or if they are spherical, expression (1) is correct as it stands; for non-spherical

shapes the acceleration has to be calculated separately for each part of the bodies and then added together. The centre of summarized volume of holes V obviously coincides with the center of mass of body. From formula (1) follows that G_m (in Newtons) is a force of attraction between two points that emits during a second a stream of holes with summarized volume V_0, which is a sphere with radius one meter, and the distance between points are $R = 1$ m. Also the formula 1 works only if a hole field is weak and bodies move slowly in comparison with the speed of light. Formula 1 use pointlike sources of holes whereas the real picture is some different. A material body radiates holes by each component particle due to it creates some distribution of holes in space (the curvature of space-time). Because of these "simplifications" in above formula appear errors as discrepancy in Mercury's orbit. It is known that orbits precess in a way unexpected in Newton's theory of universal gravitation law. The main parameter of hole gravitation as the summarized volume V_0 can be calculated without using of notion "mass" or Newton gravitational law, proceeding from geometrical reasons only. If we have measured the acceleration of free fall g of test body, the summarized volume of holes V_0 emitted during a second by gravitating body is:

$$V_0 = \frac{4\pi(R^3 - (R-g)^3)}{3} \tag{2}$$

Hole theory of gravitation could, therefore, be strictly considered as independent of the concept of mass, and the fact that formula (1) can be transformed very simply to Newtons formula is the proof of its validity only. Actually, why is the concept of mass necessary in general? The concept of "mass" was introduced in antiquities for such purposes as trade, construction etc. But now this physical parameter simply duplicates such fundamental concepts as length, volume, and time. It is possible to exclude completely the concept of mass by measuring the inertia and gravitation of body in volume units m^3 the volume of holes emitted by body in time unit. There 1 kg is equivalent to the volume $4\pi G_v$ (cubic meters). The volume V_0 relates to mass by expression: $V_0 = 4\pi G_v M$; where M is the mass of body, $G_v = 6.672 * 10^{-11}\ m^3/kg$ the coefficient of transformation of mass in volume, that numerically is equal to gravitational constant, but with other units of measurements m^3/kg. The summarized volume

of holes emitted by a body that exist at the distance $r >> R$ from the centre of hole V_0 can be represented as

$$g = \frac{r^3}{3R^2} \tag{3}$$

There g can be understood as the acceleration of free fall. We can explain now the curvature of space-time using properties of Descartes vacuum (holes in space-time) only. The properties of space, as well as properties of any body should depend on its component particles. For example, if to increase the concentration of holes in space, the properties of space should be displaced to properties of the hole. The main property of a hole (Descartes vacuum) is that the extension property tends to zero and time runs infinitely slow. Therefore, if we increase the concentration of holes in space, it would results in contraction of all distances between any two points and time retardation, because in the limiting case when space consists of holes only, the distance between any two points are equal to zero and time runs infinitely slow. The given effect of length contraction and time retardation near massive bodies was called a curved space-time. Hole gravitation describes gravitation as the influence of physical matter on properties of space-time which in turn influences the movement of a matter and other physical processes: The matter bends space-time by emission of streams of holes, and this curvature shown as gravitation, influences the movement of matter.

5 The geometrical explanation of gravitational attraction using holes

We may show the gravitational attraction between two bodies by means of the holes, using the property of holes to collapse as a Descartes vessel. It is difficult to show the attraction process with every elementary hole, therefore we shall collect all holes emitted by mass M of the Earth during a second, having received a hole with volume $V_0 = 4\pi G_v M$. Thus, it is possible to substitute the Earth by equivalent hole V_0 which collapses every second.

Let the test body N exist at rest on distance R from the centre of hole V_0, as show Figure 2. At the moment of time t_0, a hole V_0 begins to collapse and to the moment t_1 the volume V_0 will be equal

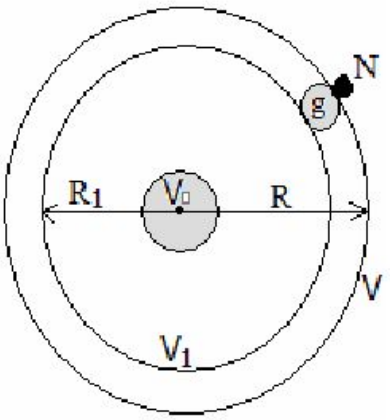

Figure 2: The test body N exists at rest on distance R from the hole V_0.

to zero. Therefore, the sphere V decreases on size: $V - V_0 = V_1$ due to a hole with diameter g appears between N and sphere V.

$$g = R - R_1 = R - \sqrt[3]{R^3 - r_0^3} = 9.8m \tag{4}$$

Now a hole g collapses as a Descartes vessel, where body N and Earth are the walls of vessel. Therefore both N and Earth will move with acceleration to the centre of hole g, and N passes the distance $S_1 = 4.9m$ up to the centre of hole, but with the speed $V = 9.8m/s$ concerning the Earth. The next second t_2 body N passes the distance of $9.8m$ by inertia, and besides, is again accelerated by a hole g, moving to the centre of hole g together with Earth the distance $4.9m$. Thus the body has passed distance $S = S_1 + 9.8 + 4.9 = 19.6m$. All things considered, an object starting from rest will attain a speed of $9.8m/s$ after one second, $19.6m/s$ after two seconds, and so on. Continuing this experiment we shall find, that the body moves by the law

$$S = \frac{gt^2}{2} \tag{5}$$

which describes the free falling in a gravitational field. Thus the material bodies fall in a hole field just as in a gravitational field, consequently hole radiation is a gravitation. In the hole theory, the effects of gravitation are ascribed to space-time curvature instead of a force. The cause of gravitation is due to vacuum holes change the geometry of space-time, which causes inertially moving objects (Earth and test body) to tend to accelerate towards each other (without any forces). The hole theory explains both Newton and Einstein gravitation theories and makes following predictions:

1. Hole theory predicts the gravitational contraction and time dilation near the source of vacuum holes (a massive body), because in the Descartes vacuum the property of extension tends to zero and time dilation is infinite.

2. Hole theory predicts that the speed of gravity must be equal to the speed of light in vacuum because a hole cannot collapse faster than light. Therefore, the speed of gravitation cannot be faster than light.

3. Hole theory predicts the fluctuation of space-time geometry at subatomic scales because of appearance of holes in space-time. Since "inside of hole" the property of extension tends to zero and time dilation is infinite, the appearance of holes led to the fluctuation of geometry.

4. It explains the absence of the gravitational repulsion - the hole model allow attraction only.

5. The theory explains why no graviton has ever been detected; because a vacuum hole is "nothing" and cannot be observed or detected by definition. We cannot see or detect "nothing", but we can find the source of holes indirectly via detection of the gravitational contraction and time dilation.

6 Conclusions

In this paper I have tried to explore the Descartes ideas about vacuum in order to build the gravitation theory. Gravitation appears simply because of interaction between matter and space-time, causing the holes to flow. It is then easy to see that the length contraction and time dilation near massive body appear because of properties of Descartes' vacuum. Also the hole theory explains gravitational attraction using geometrical reasons only.

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