Revisiting the Ether Approaches Ⅱ: Physics free from Relativity

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Revisiting the Ether Approaches II: Physics free from Relativity

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This paper visualizes the problems of relativity: Relativity cannot explain the aberration, especially water-filled telescope experiment by Airy. Then, the alternative theory of relativity, ether theory, is presented. We propose physics free from relativity which refutes the principle of relativity, invariant light speed with regard to the observer, mass energy equivalence, Lorentz transformation, and spacetime symmetry. Maxwell equations are Galilean invariant. Schrödinger equation is not Lorentz invariant. Quantum mechanics is also free from relativity; Lévy-Leblond ["Nonrelativistic Particles and Wave Equations," Commun. math. Phys. **6**, 286, (1967)] showed that spin is not relativistic effect. Furthermore, the curvature of spacetime and the accelerating universe are refuted. Gravitational wave is not disturbances in the curvature of spacetime but acoustic wave in the ether. I propose experiment aboard the ISS: the measurement of the permittivity ε_0 and permeability μ_0 of free space in 9% small gravity with weightlessness condition. It is time to discuss physics free from relativity and back to the ether theory.

> I think that the idea of the aether should be taught to students as a pedagogical device, because I find that there are lots of problems which are solved more easily by imagining the existence of an aether.
>
> J. S. Bell, 1993

Key words: Principle of relativity, mass energy equivalence, Lorentz transformation, space time symmetry, ether

1. Introduction

The theory of special relativity relies on the principle of relativity, the theory of general relativity does on the equivalence principle of gravitation and acceleration. The theory of special relativity will be denied by Phipps's counterexample[1,2] of the Principle of Relativity. Phipps[1] noted the global positioning system (GPS) evidence for clock rate asymmetry; that is, only the GPS clocks suffer time dilation.

In the GPS satellites, gravitation is cancelled to be weightless by centrifugal acceleration. However, Ashby[3] reported that there are 45.7 μs time gains every day by gravitational potential difference. Gravitational time dilation at the height 20,000 km of GPS orbit is not cancelled. Weight is cancelled but time dilation is not. Therefore, acceleration can be distinguished from a real gravitational field due to mass.

It was noted that Newton's ideas of time and space were discarded prematurely. Newton's law of universal gravitation should be reviewed; Newton's gravitational lensing generates Newton's gravitational ring (see section 10.2).

An alternative theory of relativity is the ether theory. Bell, who is known as Bell's inequality, stated in the interview with Davies[4] that "Well, what is not sufficiently emphasized in textbooks, in my opinion, is that the pre-Einstein position of Lorentz and Poincare, Larmor and Fitzgerald was perfectly coherent, and is not inconsistent with relativity theory. The idea that there is an aether, and these Fitzgerald contractions and Larmor dilations occur, and that as a result the instruments do not detect motion through the aether - that is a perfectly coherent point of view." Thereafter, "Well, on the grounds of philosophy; that what is unobservable does not exist. And also on grounds of simplicity, because Einstein found that the theory was both more elegant and simpler when we left out the idea of the aether. I think that the idea of the aether should be taught to students as a pedagogical device, because I find that there are lots of problems which are solved more easily by imagining the existence of an aether. But that's another story. The reason I want to go back to the idea of an aether here is because in these EPR experiments there is the suggestion that behind the scenes something is going faster than light. Now, if all Lorentz frames are equivalent, that also means that things can go backward in time." Bell[4] first pointed out the relation between the ether and entanglement.

Bell[4] pointed out that the ether theory is not inconsistent with relativity theory. Therefore, in this article, we show that aberration cannot be explained by relativity theory (see section 6.)

Rafelski[5] noted "However, it is important that students and scholar of Special Relativity recognize Einstein's evolution to acceptance of non-material realistically invariant aether." In 1920, Einstein[6] first represented the evolving view of the ether noting that "we may say that according to the general theory of relativity space is

endowed with physical qualities; in this sense, therefore, there exists an ether."

In this article, both the special and general relativity theories are refuted. Thereafter, physics free from relativity is proposed. It is time to reexamine the property of ether.

2. Physical meaning of relativity

The purpose of this article is a critical examination of relativity. Therefore, it is useful to clarify the physical meaning of relativity. For example, there are two interpretations of the Lorentz length contraction; one is "a change of coordinates" by Lord[7], and the other is "a moving length contracts" by Rafelski[5], and Günther and Müller[8]. In this report, we do not accept Lorentz length contraction.

2.1 De Broglie wave and relativity[9]

The kinetic energy of moving object is represented by a de Broglie wave[9] which is represented by $(\gamma-1)mc^2$, where m is the rest mass, $\gamma=\frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$ is the Lorentz factor, v is the velocity defined in the ECI coordinate system, and c is the speed of light. In the theory of relativity, the limit $v/c \rightarrow 0$ is Newtonian limit. Where the wave energy is represented by Newtonian formalism as $(\gamma-1)mc^2=\frac{1}{2}mv^2$.

2.2 Physical meaning of the relativistic mass

Let us make the relativistic mass clear[9]. The relativistic mass is represented as γm, which is the summation of the rest mass m and the mass of de Broglie wave $(\gamma-1)m$. Where, $(\gamma-1)m$ is the real mass of photon that is radiated as synchrotron radiation. Therefore, the relativistic mass is considered to be the rest mass adding an adhered photon mass.

2.3 Physical meaning of the Lorentz factor

The Lorentz factor is represented by the interaction interval of photon actions, thus depends on the path length of a travelling photon which transfers the force acting on the object. Therefore, the Lorentz factor is represented using square root of v and c.

The Lorentz factor relates to time dilation not length contraction[10].

2.4 Physical meaning of Lorentz covariance

In this paper, covariance is equivalent to form invariance; that is, the laws of physics take on the same form. Minkowski[11,12] introduced covariant form of time and length to satisfy the constancy of the speed of light. the Lorentz length contraction and Lorentz time dilation is mathematically represented to satisfy $x^2 + y^2 + z^2 - (ct)^2 = k^2$ (k is constant); that is, some sort of union of space and time shall preserve independence. Physical meaning is the length and time vary to make the speed of light c constant.

Lévy-Leblond[9] showed criticism of the emphasis put on the invariance of the speed of light in standard derivations of the Lorentz transformation, thereafter showed another derivation.

Phipps[13] denied covariance describing that "Covariance masquerades as equivalent to invariance." We discuss both Maxwell equations and Dirac equation are invariant under Galilean transformations. Relativity is not supported by Lorentz covariance; that is, the Lorentz covariance of Maxwell and Dirac equations does not support relativity. (See sections 5 and 7.)

2.5 Lorentz transformation

Engelhardt[9] noted that "The Lorentz Transformation, which is considered as constitutive for the Special Relativity Theory, was invented by Voigt in 1887, adopted by Lorentz in 1904, and baptized by Poincaré in 1906. Einstein probably picked it up from Voigt directly." From Wikipedia, it is noted that "In 1887 Voigt formulated a form of the Lorentz transformation between a rest frame of reference and a frame moving with speed v in the x direction."

Voigt's transformation[9] is represented:

$$x' = \mathrm{x} - \mathrm{vt}, y' = \frac{y}{\gamma}, \mathrm{z}' = \frac{z}{\gamma}$$
$$\mathrm{t}' = \mathrm{t} - \frac{vx}{c^2}. \quad \text{(a)}$$

Lorentz transformation is represented:

$$x' = \gamma(\mathrm{x} - \mathrm{vt}), y' = \mathrm{y}, \mathrm{z}' = \mathrm{z},$$
$$\mathrm{t}' = \gamma(\mathrm{t} - \frac{vx}{c^2}). \quad \text{(b)}$$

Gift[9] showed that relative simultaneity does not exist and refuted the Lorentz transformation using the GPS data. He proposed to replace by the Selleri transformations[18]:

$$x' = \gamma(\mathrm{x} - \mathrm{vt}), y' = \mathrm{y}, \mathrm{z}' = \mathrm{z}$$
$$\mathrm{t}' = \frac{t}{\gamma}. \quad \text{(c)}$$

At length contraction, we do not agree with Selleri and Gift. We proposed Galilean transformation with Lorentz time dilation[9]:

$$x' = x - vt, y' = \mathrm{y}, \mathrm{z}' = \mathrm{z}$$
$$\mathrm{t}' = \frac{t}{\gamma}. \quad \text{(d)}$$

For the measured time and reference time, in time transformation γ appears in denominator or numerator. In equation (c) and (d), it is the measured time t' runs slow. We can rewrite using the reference time t' dilates:

$$x' = x - vt, y' = \mathrm{y}, \mathrm{z}' = \mathrm{z}$$
$$\mathrm{t}' = \gamma \mathrm{t}. \quad \text{(e)}$$

Phipps[13] proposed using corrective time in which excludes not only velocity but also gravitational effects, that is, equivalent to Galilean transformation:

$x' = x - vt, y' = \mathrm{y}, \mathrm{z}' = \mathrm{z}$
$\mathrm{t}' = \mathrm{t}.$ (f)
In this transformation, clock is not light but quantum clock.

3 Counterexample of the principle of relativity

3.1 The principle of relativity

Einstein[19] noted the principle of relativity that "The laws by which the states of physical systems undergo change are not affected, whether these changes of state be referred to the one or the other of two systems of co-ordinates in uniform translatory motion." (English translation)

If things go slowly in a system, the principle of relativity will be denied.

3.2 Counterexample of the principle of relativity

Van Flandern[20] noted that "the Global Positioning System (GPS) showed the remarkable fact that all atomic clocks on board orbiting satellites moving at high speeds in different directions could be simultaneously and continuously synchronized with each other and with all ground clocks." Although Van Flandern[20] did not clearly mention, however this statement is considered to be the refutation of the principle of relativity.

In 2016, Phipps[1] first showed a counterexample of the Principle of Relativity noting that "Thus we see that in the real world the relativity principle cannot be valid for timekeeping. Proper time clocks having different accelerational histories really do run at different rates and yield different measurement results when at rest in different inertial systems." Phipps noted the global positioning system (GPS) evidence for clock rate asymmetry; that is, only the GPS clocks suffer time dilation. That is, in the earth-centered locally inertial (ECI) coordinate system, the Principle of Relativity was denied using the experimental data of the GPS. Proper time clocks are atomic clocks. Moving atomic clocks tick off time more slowly than that of stationary. This is a counterexample of the Principle of Relativity. A paradigm shift in relativity has begun.

For readers' convenience, let us illustrate the counterexample of the Principle of Relativity[2]. **Figure 1** shows the hierarchy structure of the reference frames, that is, the GPS satellite moves (v_G = 4 km/s) in the ECI coordinate system which is moving in the solar system at v_d = 30 km/s. A hierarchy structure[21] of locally inertial coordinate systems is the ECI coordinate system moving in the solar system.

Figure 2 shows a counterexample between two frames in the ECI coordinate system. A system of coordinates K is set on the earth, another system of coordinate K' is set in the GPS satellite. The number of GPS satellites is around 70, we represent all GPS satellites using K'. The systems of coordinates represented as K' have the relative velocity with regard to the earth. The velocity of the GPS satellite v_G is 4 km/s. All clocks in every GPS satellite run $1/\gamma$ times slower, where $\gamma = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$ is the Lorentz factor, v is the velocity defined in the ECI coordinate system, and c is the speed of light. Asymmetry in clock progress appears between the earth and the GPS satellites. The experimental data of the GPS shows that the clocks in the GPS satellites tick off time more slowly (7.1 μs every day) by the velocity. There are no asymmetries among the GPS satellites. That is, times are equal in every GPS satellites.

Einstein[6] noted between two systems K and K' which is moving in uniform translation relatively to K as shown in **Fig. 2** that "Now comes the anxious question: - Why must I in the theory distinguish the K system above all K' systems, which are physically equivalent to it in all respects, by assuming that the ether is at rest relatively to the K system?" The answer to this question was given by Phipps[1]: The K system can be distinguished above all K' systems.

Feynman's[22] light clocks are also shown. Time dilation is only caused by the velocity v_G = 4 km/s. There are relativistic Doppler shifts observed between the earth and the GPS satellites.

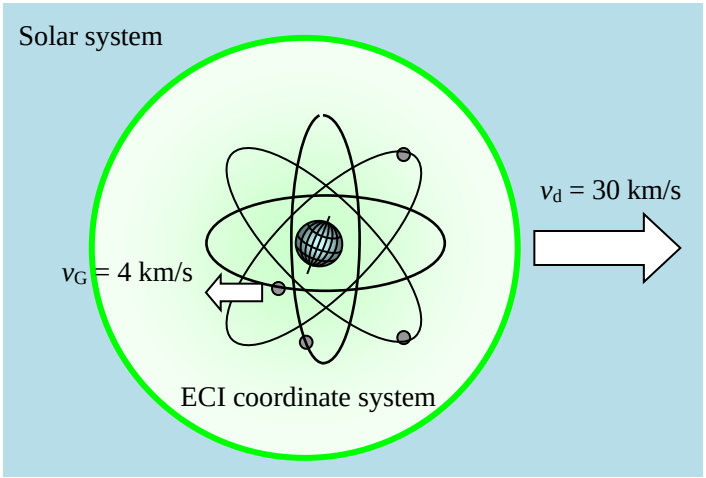


Fig. 1 Hierarchy structure[21] of reference frames: the solar system, the ECI coordinate system and the GPS satellite

Lord[7] noted that "A Lorentz transformation is a relationship between "inertial frames" chosen by two "inertial observers" who are in uniform motion relative to each other. It is merely a change of coordinates." "It does not "contract lengths" or "dilate time";" Günther and Müller[8] noted that "With respect to this system a moving clock loses time and a moving length contracts." They consider that both time dilation and length contraction are

real physical phenomena. We do not consider it is the case, length contraction is a change of coordinates, time dilation is a real physical phenomenon. The Principle of Relativity critically depends whether time dilation is a change of coordinates or a real physical phenomenon. We consider that time dilation does not have any relation to the Lorentz coordinate transformation, that is, time dilation is a real physical phenomenon; Feynman[22] used a light clock to visualize time dilation by motion. Therefore, the Principle of Relativity is denied by Phipps's[1] counterexample.

3.3 Distinguishability of stationary and moving systems

Günther and Müller[8] discussed the indistinguishability of inertial systems. Let us discuss the distinguishability of two systems. The GPS uses Newtonian absolute time; this is Phipps's collective time[14] in which not only gravitational effects but also velocity effects are eliminated. All clocks in the travelling GPS satellites and clocks on earth are synchronized in advance. The GPS satellite obtains the data of collective time and finds time dilation of the clock on board; therefore, distinguishes that the GPS satellite is moving. A system where time advances slowly is moving faster.

Figure 3 shows the thought experiment of distinguishability of two systems. To make the discussion simple, the stations on the earth are assumed two-dimensional array antenna to generate plane wave parallel to the GPS satellite orbit. The clock in the GPS satellite suffers time dilation. We cannot say that the earth is moving.

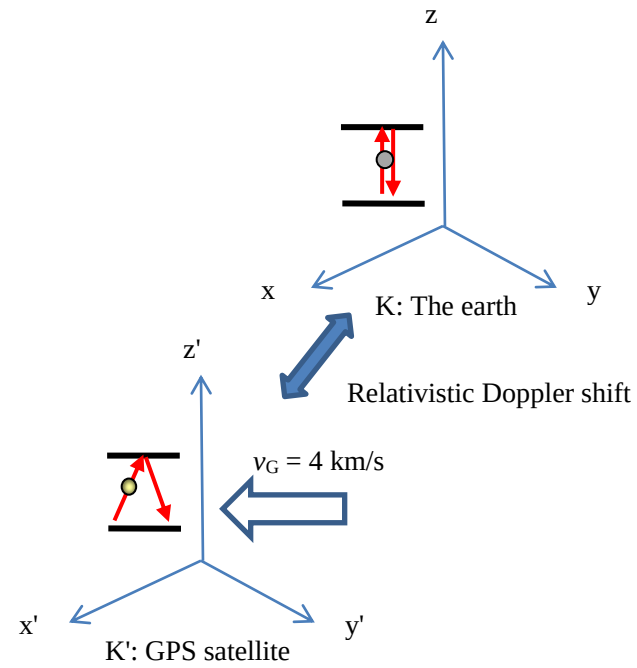


Fig. 2 Counterexample of the principle of relativity

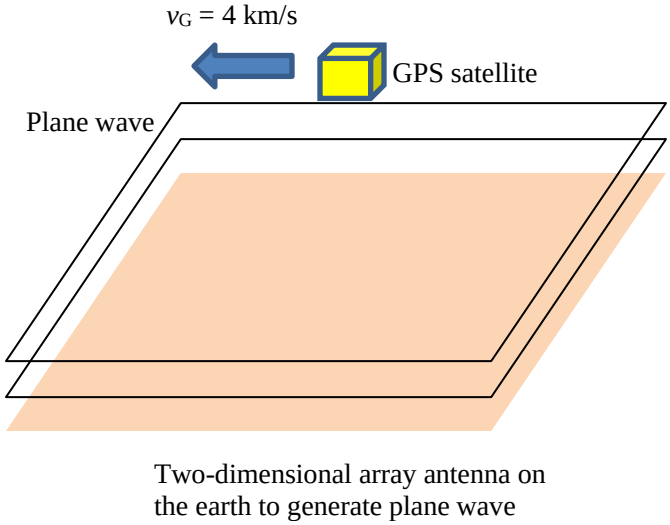


Fig. 3 Thought experiment of the distinguishability of two systems.

4. The speed of light is observer-dependent

4.1 The constancy of the speed of light

Einstein noted the constancy of the speed of light that "Any ray of light moves in the "stationary" system of co-ordinates with the determined velocity c, whether the ray be emitted by a stationary or by a moving body." (English translation) In the later part of his paper, Einstein noted that "The wave under consideration is therefore no less a spherical wave with velocity of propagation c when viewed in the moving system. This shows that our two fundamental principles are compatible." (English translation) This indicates that the velocity of electromagnetic wave is observed as invariance independent of the observer's velocity.

Many researchers have already denied the constancy of the speed of light using the experimental data of Sagnac effect and Doppler shift. These two phenomena are physically equivalent.

Wang[23] et al. reported that "Our finding is that there is a travel-time difference $\Delta t = 2v\Delta l/c^2$ in a fiber segment of length Δl moving with the source and detector at a speed v, whether the segment is moving uniformly or circularly." Suleiman[24] noted that "the circular Sagnac effect is fully explainable in the framework of inertial systems," the Sagnac effect can be discussed over a one-way path.

Gift[25] showed that Doppler shift reveals light speed variation. The merit of discussion using Doppler shift is that the discussion can be carried out in inertial frame.

For readers' convenience, let us show that the speed of light is observer-dependent using Doppler shift. **Figure 4** shows the Doppler shift of the carrier and modulated waves. The wave form in (a) shows the modulated wave observed by a stationary observer, the wave form in (b) is the modulated wave observed by a moving observer. The modulated wave as well as the carrier wave suffers the Doppler shift. Stationary observer detects the speed of light $\frac{L}{\Delta t_s} = c$. Moving observer toward the source does $\frac{L}{\Delta t_m}$. Therefore, $\frac{L}{\Delta t_s} = c < \frac{L}{\Delta t_m}$. That is, the speed of light is observer-dependent. In this discussion, for simplicity, Lorentz factor $\gamma = \frac{1}{\sqrt{1-\left(\frac{v}{c}\right)^2}}$ is neglected; this is because, at v=0.47 km/s, Lorentz factor (γ-1= 1.23×10^{-12}) is 10^{-6} compering with v/c=1.57×10^{-6}, therefore negligible.

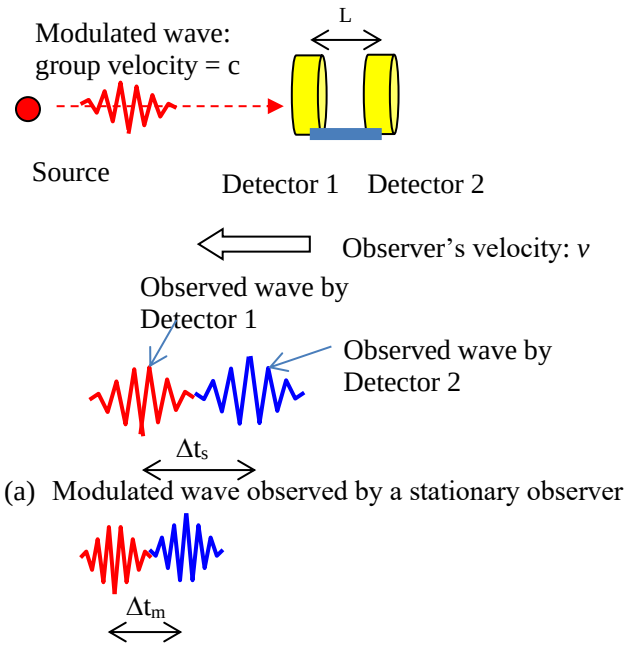


Fig. 4 Doppler shift of carrier and modulated waves reveals that the speed of light is observer-dependent.

5. Refutation of the Lorentz transformation

5.1 Refutation of the Lorentz contraction

Lorentz contraction was proposed to explain the experimental results of Michelson-Morley. Let us look back the conclusion of Michelson-Morley[26] paper in 1887; that was "the ether is at rest with regard to the earth's surface." Therefore, we do not consider that the Lorentz contraction is suitable to explain the Michelson-Morley's experimental results.

Although Michelson-Morley's experiment is considered to compare photon's arrival times in two arms, Michelson-Morley's experiment is interferometer experiment; let us consider a single photon Michelson-Morley's experiment[27] as shown in **Fig. 5**. In interferometer experiment, null results mean that there is no length change of the arm. Therefore, the Michelson-Morley's experimental results do not show length contraction.

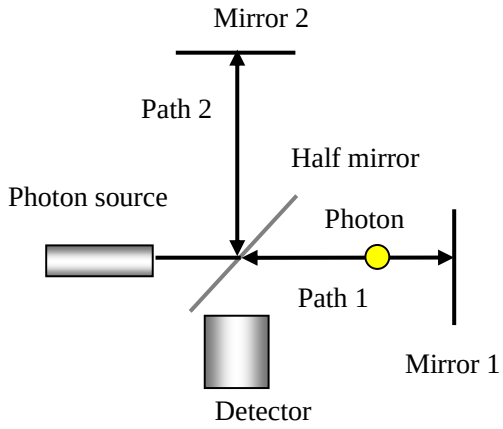


Fig. 5 Single-photon Michelson-Morley experiment[27] There is only a single photon in the Michelson interferometer: in spite of the single photon, interference is observed. This experiment does not show the simultaneous arrival of two photons.

5.2 Lagrangian and Eulerian descriptions[28]

Today's Maxwell equations are Eulerian description. Original Maxwell equations used Lagrangian description. Lagrangian description is material description and Eulerian description is spatial description; that is, the Lagrangian description (d/dt) is fixed to the drifting material.

Figure 6 shows the Lagrangian description (d/dt) and the Eulerian description $(\partial/\partial t)$ in two dimensions. If we observe a drifting object from a drifting boat which is fixed to the drifting material, then we use the Lagrangian description (d/dt); if we observe a drifting object from a bridge which is spatially fixed, then we use the Eulerian description $(\partial/\partial t)$.

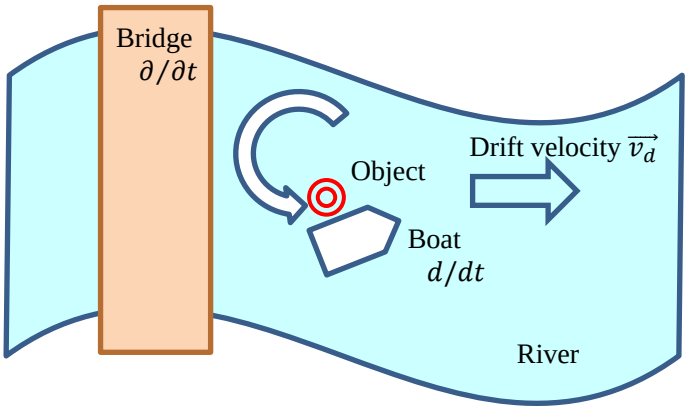


Fig. 6 Lagrangian description (d/dt) and Eulerian description ($\partial/\partial t$) in two dimensions: According to Hertz, we consider that drift velocity $\overrightarrow{v_d}$ represents that of the ether.

5.3 Maxwell equations are Galilean invariant

In the late 19th century, almost all scientists believed in the ether, they considered that Maxwell equations are Galilean invariant, since the Galilean transformation is the only one in those days. This is the premise. Hertz's[29] Galilean invariant form of Maxwell equations was simple and intuitive. Phipps[14] summarized Hertz's works.

Today's Maxwell equations look symmetric in space and time, thus looks Lorentz covariant.

Hertz's Galilean invariant form of Maxwell equations are represented as,

$$\nabla \times \vec{E} = -\frac{d\vec{B}}{dt}, \quad \nabla \times \vec{H} = \vec{j} + \frac{d\vec{D}}{dt}$$
$$\nabla \times \vec{D} = \rho, \quad \nabla \cdot \vec{B} = 0 \qquad (1)$$

The convective derivative is defined from standard traditional field theory as,

$$\frac{d}{dt} = \frac{\partial}{\partial t} - \nabla \times (\overrightarrow{v_d} \times) + \overrightarrow{v_d}(\nabla \cdot) \qquad (2)$$

where, $\overrightarrow{v_d}$ is the drift velocity of the ether combine with matter. Phipps noted that equation (1) is invariant under the Galilean transformation. Hertz used the standard traditional field theory, thus assumed the ether drift. Phipps did not assume the ether, and therefore noted that Hertz's assumption of ether drift velocity $\overrightarrow{v_d}$ was a fatal mistake. We do not think it is the case, Hertz was correct; $\overrightarrow{v_d}$ is the drift velocity of ether[30].

5.4 Refutation of the spacetime symmetry

Minkowski[11] proposed the idea of spacetime that "Henceforth, space for itself, and time for itself shall completely reduce to a mere shadow, and only some sort of union of the two shall preserve independence." (English translation) We consider that this was the starting point of spacetime symmetry. Minkowski[12] noted that "At the present time, different opinions are being held about the fundamental equations of Electrodynamics for moving bodies. The HERTZian forms must be given up, for it has appeared that they are contrary to many experimental results." (English translation)

Minkowski did not accept Hertzian form, thus introduced covariant form of time and length to satisfy the constancy of the speed of light. As was pointed out by Minkowski[12], in a laboratory scale experiment by Eichenwald and Wilson[31], rotation $\nabla \times (\overrightarrow{v_d} \times)$ did not generate any magnetic field. However, this experimental result does not rule out Hertzian form. Let us use the convective derivative excluding $\nabla \times (\overrightarrow{v_d} \times)$ from equation (2),

$$\frac{d}{dt} = \frac{\partial}{\partial t} + \overrightarrow{v_d}(\nabla \cdot) \qquad (3)$$

Thus, original Maxwell equations are not shown to be spacetime symmetry. That is, $\frac{d}{dt}$ is not symmetry with $\frac{\partial}{\partial x}$.

5.5 Derivation of today's Maxwell equations by Hertz

Hertz had known the results of the Michelson-Morley experiment that the ether is at rest with regard to the earth's surface, and thus, at the earth's surface, he set $\vec{v}_d = 0$. This is today's Maxwell equations.

$$\nabla \times \vec{E} = -\frac{\partial \vec{B}}{\partial t}, \quad \nabla \times \vec{H} = \vec{j} + \frac{\partial \vec{D}}{\partial t} \qquad (4)$$

Although Hertz derived equation (4) for the surface of the earth where the ether is at rest; however, in the early of the 20th century, this equation was walking alone as the equation for universal condition. Again, $\frac{d}{dt}$ is symmetry with $\frac{\partial}{\partial x}$ at the surface of the earth where the ether is at rest.

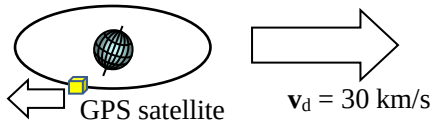
6. GPS clocks variation

GPS clocks variation[28] in the solar system cannot be explained by the theory of relativity. **Figure 7** shows that the summation of the velocity of the earth v_d and the velocity of the GPS satellite v_G in the solar system is periodically changed every 6 hours. The reference time t_G is calculated using equation (3) from the Lorentz transformation by setting v_d= 30 km/s and v_G= 4 km/s,

$$t_G = \frac{t_0}{\sqrt{1-\left(\frac{v_d+v_G}{c}\right)^2}} \qquad (5)$$

The reference time t_0 is the time of the stationary state in the solar system eliminating the gravitational effect. Equation (5) shows that there is a periodic deviation depending on the velocity $(v_d+v_G)^2$. The maximum deviation of the reference time t_G is calculated as $\Delta t_G = \pm 1.3\times10^{-9}$. The deviation Δt_G is periodic, which causes a deviation in distance of around 0.28 km. However, the earth-centered locally inertial (ECI) coordinate system operates well by the GPS satellites, meaning no periodic

distance deviation is observed. Therefore, GPS clocks cannot be explained by the theory of relativity.



v_G = 4 km/s, around 12 hours in one rotation

Fig. 7 GPS clocks in the solar system

7. Aberration: Water-filled telescope experiment by Airy

7.1 Aberration cannot be explained by the relative velocity

If the observer moves, the optical aberration is observed. Here, we will discuss the 20 arc seconds annual aberration discovered by Bradley. Both the Sun and Mercury show the aberration angle of 20 arc seconds, although the Sun and Mercury have deferent relative velocities with regard to the earth as shown in **Fig. 8**. The relative velocities of Mercury become from 17 km/s to 77 km/s. Venus also shows 20 arc seconds aberration. Therefore, the relative velocity cannot explain aberration; the revolution velocity of the earth 30 km/s looks to decide the aberration of 20 arc seconds.

Let us consider the relativity of aberration angle seen from the earth and Mercury. If we are on Mercury and see the earth, we will observe around 31 arc seconds aberration; relativity will not be satisfied between the earth and Mercury, this is another counterexample of the principle of relativity. It was pointed out that the moon shows 0.7 not 20 arc seconds aberration; therefore, the revolution velocity cannot explain aberration. We show the explanation of aberration in section 7.3.

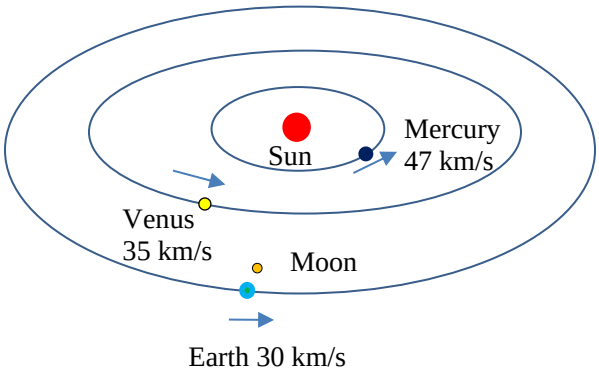


Fig. 8 Aberration is decided by the revolution velocity of the earth 30 km/s, not the relative velocity between Mercury and the earth. Moon does not show aberration.

7.2 Water-filled telescope experiment by Airy

We consider that the water-filled telescope experiment by Airy can give a judgement for relativity[28]. We do not consider that relativity give a solution for the experimental results.

Figure 9 provides an explanation of the aberration by Bradley: The Earth's revolution velocity (30km/s) makes the stellar light from the top seem as if it comes from the front. The dotted line is considered to be the apparent direction of the light. **Figure 10** presents the water-filled telescope experiment by Airy: The direction of the light was unchanged. To satisfy the experiments in **Figs.9** and **10**, the dotted line was considered not to be the apparent but rather the true direction of the light.

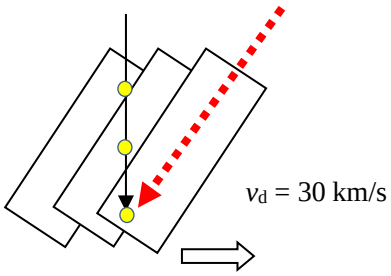


Fig.9 Explanation of the aberration by Bradley: The earth's revolution velocity (30 km/s) makes the stellar light from the top seem as if it comes from the front. The dotted line was considered to be the apparent direction of the light.

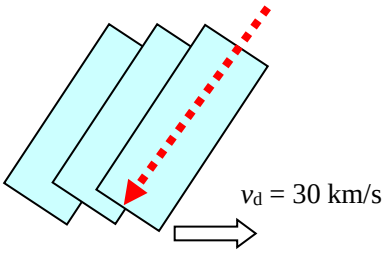


Fig. 10 Water-filled telescope experiment by Airy: The direction of the light was not changed. The dotted line was considered to be not the apparent but the true direction of the light.

7.3 Explanation of aberration

Figure 11[28] explains the aberration using the Stokes's ether model in the distance scale of the earth and the moon (the radius of the ether sphere is more than 380,000km). Both the particle model and the wave model, at the surface of the dragged ether sphere, the particle and the wave refract according to $sin\alpha \sim \alpha \sim \frac{v}{c}$, photons hit the front of the ether sphere; thus, we see the photons at an angle α according to Huygens's principle which shows the front surface becomes a new source of light. The aberration is

caused by the refraction by moving ether sphere. The wave front changes its direction to enclose the dragged ether sphere. The height of the dragged ether sphere from the ground is more than 380,000km, which is the distance from the earth to the moon. The minimum distance of 380,000km is estimated from the experimental evidence that there is little aberration of the moon light[32].

Let us consider the moon's aberration. Van Flandern[32] estimated around 0.7 arc seconds by the relative velocity of 1 km/s. However, as pointed out by Van Flandern[32], aberration depends on the velocity of the observer not the relative velocity. The barycenter is in the earth, that is, the earth is assumed to be stationary in the gravitational field of the earth. Therefore, there is little aberration of the moon.

We consider the explanation of the aberration by the Stokes's ether dragging hypothesis is simple. As shown in **Fig. 10**, the photons represent the true direction of the light with respect to the ECI coordinate system.

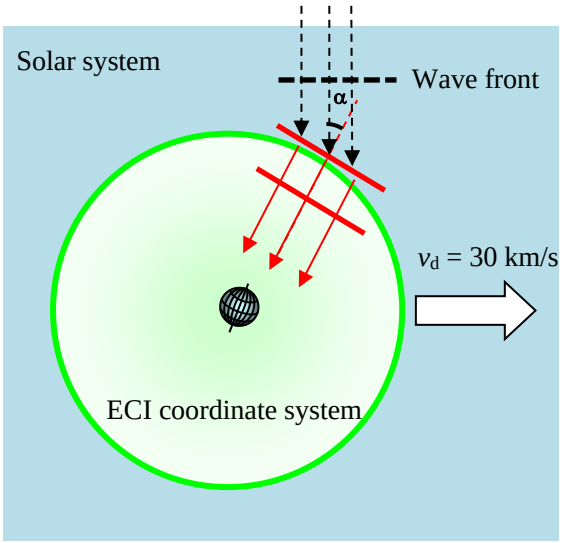


Fig. 11 Explanation of the aberration by Stokes' ether dragging model[28]

8. Quantum physics free from relativity

It is considered that relativity is compatible with Lorentz invariance. Thus, Lorentz invariance is used to support relativity in quantum physics. I do not consider it is the case. Physics should not be restricted by relativity; that is, physics does not need to be Lorentz invariant. As was shown in section 5.1, Maxwell equation is not Lorentz invariant. Let us discuss quantum physics.

8.1 De Broglie waves and Schrödinger equation

Schrödinger equation is not Lorentz invariant. This tells everything; that is, quantum physics is free from relativity. We showed that the difference between de Broglie waves and Schrödinger equation is the rest mass[9]. The de Broglie wave includes the rest mass, but the Schrödinger equation does not. If the rest mass is excluded, de Broglie waves become free from relativity.

In 1928, Dirac[33] derived Dirac equation from Klein-Gordon equation which has dispersion relation including rest mass energy mc^2. Therefore, Klein-Gordon as well as Dirac equations were considered to be relativistic. Dirac equation derived spins; thus, it was believed that spin is relativistic phenomena. I do not consider it is the case.

8.2 Lévy-Leblond's paper

Schrödinger equation was derived using the nonrelativistic dispersion relation of equation (6), at this stage without potential energy.

$$E = \frac{p^2}{2m} \qquad (6)$$

$$\therefore i\hbar\frac{\partial\varphi}{\partial t} = -\frac{\hbar^2}{2m}\frac{\partial^2\varphi}{\partial x^2} \qquad (7)$$

Lévy-Leblond[34] made linearization of the Schrödinger equation describing that "We shall now derive such a wave equation, which will turn out to describe spin 1/2 particles, using the heuristic idea that DIRAC applied so successfully in RQM;" where, linearization means transforming the second order space differential equation into a first order space differential equation using matrix. Lévy-Leblond noted that "A complete nonrelativistic theory predicts the correct value for the intrinsic magnetic moment of a spin 1/2 particle."

In this section, we showed from spin derivation by Lévy-Leblond that spin is not the relativistic effect. Therefore, quantum mechanics cannot support relativity.

8.3 Refutation of the mass energy equivalence

$E = mc^2$ relates to quantum mechanics rather than the theory of special relativity[35]. Using the quantum mechanical momentum conservation law between massive particle and photon, the discussion does not need to carry out using the theory of special relativity.

From quantum mechanics, we obtain for the energy of photon $\varepsilon = c\mu$. Assuming a photon transfers the invariant mass Δm at the speed of light c, the momentum of photon is $\mu = \Delta m \times c$, therefore, $\varepsilon = c\mu = \Delta mc^2$. This represents the energy of photon, not the equivalence of the mass and energy.

Nuclear fission and fusion are release of photons from atom with energy and mass; it does not show the equivalence of the mass and energy.

This relates to the light bending by gravity (see section 9).

9. Refutation of the curvature of spacetime

Gravitational lensing is not caused by the curvature of spacetime but by the property of photon itself.

9.1 Space, time and gravitation by Eddington[36]

In his book, Eddington[36] discussed the mass and inertia of light, he might be already aware of light bending by Newtonian mechanics. That is, the magnification of Newton gravitational lensing is half. Therefore, Newton gravitational lensing should be used $E=mc^2$ instead of $E = \frac{1}{2}mv^2$ for photons.

Light bending by gravity is two times greater than that of ordinary particles. Eddington[36] calculated the light bending by the sun to be 1.75″ using the theory of general relativity; that of Newtonian mechanics was 0.87″. In 1801, using Newtonian mechanics Soldner[37] calculated to be 0.84″.

The light bending by gravity becomes 2 times greater without assumption of the curvature of spacetime. Einstein's gravitational ring is equivalent to Newton's gravitational ring[38].

9.2 Schwarzschild radius for a photon

In the theory of relativity, the limit $v/c \to 0$ is Newtonian limit; however, the theory of relativity does not degenerate to Newtonian mechanics in the limit $r \to \infty$. (Where v is the velocity, c is the speed of light, r is the distance from the mass.) Schwarzschild radius $r_S = \frac{2GM}{c^2}$ was calculated under the assumption of degeneration to Newtonian mechanics in the limit $r \to \infty$. However, this assumption was not correct; that is the light bending by the gravity is two times greater in weak gravitational fields. Schwarzschild radius for a photon r'_S is represented as $r'_S = \frac{GM}{c^2}$ in Newtonian mechanics using $E= mc^2$ instead of $E = \frac{1}{2}mv^2$. That is, Schwarzschild radius for a photon is half.

Light bending by gravity is caused by the property of photon not the curvature of spacetime[38]. We should get back to space and time from spacetime.

10. Equivalence principle

The equivalence principle of gravitational and inertial masses was experimentally confirmed. However, there is a question about the equivalence principle of gravitation and acceleration.

10.1 Gravitational and inertial masses

The resistance (i.e., the impedance) from accelerated motion in the ether is considered to be inertia. Inertia is an eddy making resistance generated by the accelerated motion of a massive particle in the ether. The resistance in the ether is isotropic; thus, the inertial mass is equivalent to the gravitational mass[39].

We consider that ether originates from mass. The gradient in the ether density results from the mass distribution.

At the same time, the equivalence of the inertial and gravitational masses leads us to represent the ether density distribution as an exponential function $y = e^{-\frac{1}{r}}$, as shown in **Fig. 12**[39]. This form, proposed by Hatch[40], is chosen because satisfies $\frac{dy}{dr} = \frac{1}{r^2}y$.

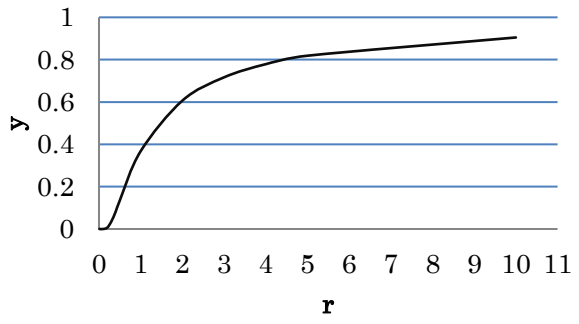


Fig. 12 Illustration of the equation $y = e^{-\frac{1}{r}}$, which is used to model the distribution of the ether density from a point mass

10.2 Exclusion of the gravitational singularity

In **Fig. 13**, the solid line corresponds to $\frac{dy}{dr} = \frac{1}{r^2}e^{-\frac{1}{r}}$ and the dotted line corresponds to $\frac{dy}{dr} = \frac{1}{r^2}$. Two lines are asymptotic, at the same time, the solid line excludes the gravitational singularity at r=0.

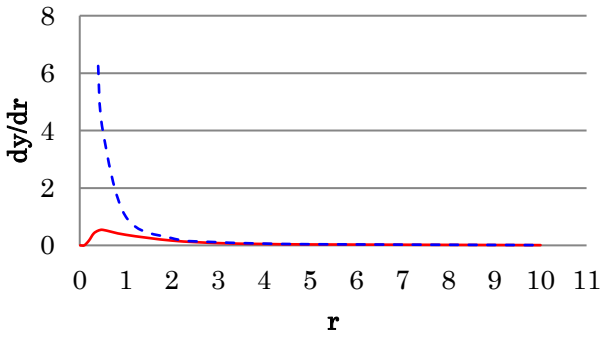


Fig. 13 Plot of equations: the solid line corresponds to $\frac{dy}{dr} = \frac{1}{r^2}e^{-\frac{1}{r}}$ and the dotted line corresponds to $\frac{dy}{dr} = \frac{1}{r^2}$.

10.3 A possible solution of galaxy rotation problem: refutation of dark matter

The equivalence of the inertial and gravitational masses may show a solution of galaxy rotation problem. The gravitational mass decreases according to the distance from the supermassive black hole, therefore inertial mass decreases. The momentum conservation makes to increase the velocity according to the decrease of inertial mass. The

decrease of the inertial and gravitational masses may cause flat rotation curve (solid line) as shown in **Fig. 14** without dark matter.

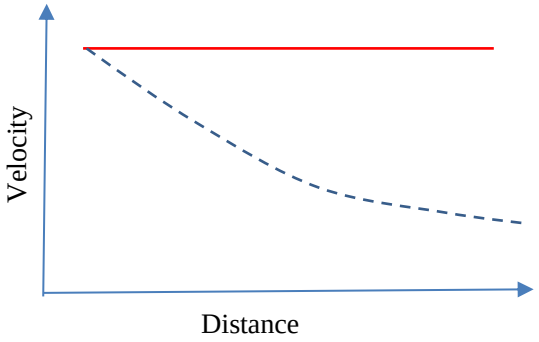


Fig. 14 Flat rotation curve

10.4 Absence of the Noon-Midnight redshift

It is known that two clocks fixed on the Earth's surface, when compared to each other, do not display a frequency difference due to external masses (Sun, Moon). Absence of the Noon-Midnight redshift was discussed by Hoffmann[41] noting that Noon-Midnight redshift is cancelled by the relativistic Doppler effect.

Hoffmann's arguments were criticized by Ashby and Weiss[42] using the effect of acceleration cannot be distinguished from a real gravitational field due to mass. **Figure 15** shows two explanations of absence of the Noon-Midnight redshift; one is the cancellation by the relativistic Doppler effect[41,43], and the other is the cancellation of gravitation by acceleration[42,44]. Montenbruck[45] et al. reported GPS satellite clock variations of orbit dependency. At low angle (the sun is in the GPS orbital plane), the deviations of the GPS clocks were observed.

We consider that the ether sphere is deformed to cancel the effects due to external masses.

10.5 Question about the equivalence principle of gravitation and acceleration

Ashby and Weiss[42] noted a freely falling elevator in earth's gravity field cancels the real gravitational field strength, resulting in weightlessness within the elevator.

In the International Space Station (ISS), the gravity becomes around 9 % smaller comparing to the Earth. Therefore, according to the equivalence principle of the gravitational and inertial masses, the inertial mass also becomes 9 % smaller. The mass moves 9 % easier in the ISS than on the earth. That is the inertia is not cancelled in the ISS. On the moon, both weight and inertia become 1/6.

We do not consider that a freely falling elevator in earth's gravity field cancels the real gravitational field.

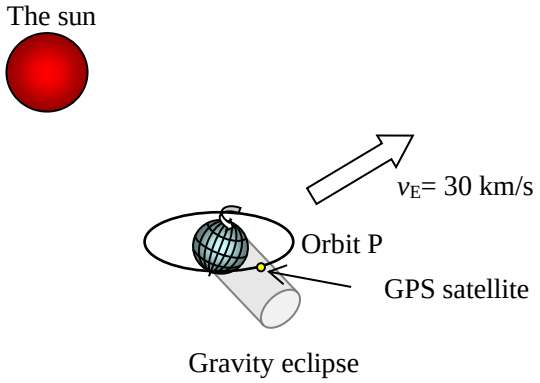


Fig. 15 Gravity eclipse by the earth (shadowed area): GPS satellite on orbit P is eclipsed by the earth. The clocks on the GPS satellites show periodic variations. Not the velocity but the eclipse by the earth affects the reference times of the GPS satellites.

11. Gravity

Maxwell[46] noted that "Newton himself, however, endeavored to account for gravitation by differences of pressure in an aether, but he did not publish his theory." We assume the idea by Newton that the gradient of the ether density causes the gravitation: $g \propto -\frac{\partial \rho_E}{\partial x}$. It is also assumed that the gravitation is action at a distance (i.e., entanglement). The speed of gravitational wave is the speed of light (see section 12).

11.1 The speed of gravity by Van Flandern

Van Flandern[16] noted that "Why do total eclipses of the Sun by the Moon reach maximum eclipse about 40 seconds before the Sun and Moon's gravitational forces align?" **Figure 16** shows the illustration of notation by Van Flandern. Angle α is not on scale; 20 arc seconds are around 1% of the apparent diameter of the Moon. From the deference between total eclipses of the Sun and the Sun and Moon's gravitational forces align, Van Flandern[16] estimated that the speed of gravity is at least 20 times greater than that of the light c. After 38 ± 1.9 seconds from total eclipse, the Sun and Moon's gravitational forces align occurs as shown in **Fig. 17**. At 38 seconds, the speed of gravity is infinite, at 1.9 seconds later, the speed of gravity is 38 ÷ 1.9 = 20 times greater than that of light c; this was explained by Van Flandern[20].

Although **Fig. 16** shows that the gravity is interaction between the sun and the earth but light is propagation from the sun to the earth. Thus, it may explain that the aberration occurs only on light propagation; however, the speed of gravity is not assumed by equation $sin\alpha \sim \alpha \sim \frac{v}{c}$.

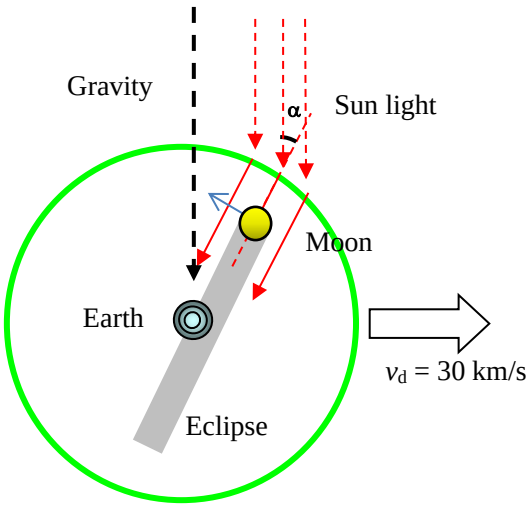


Fig. 16 Total eclipses of the Sun by the Moon and the Sun and Moon's gravitational forces align explained by Van Flandern[20]. (Angle α is not on scale.)

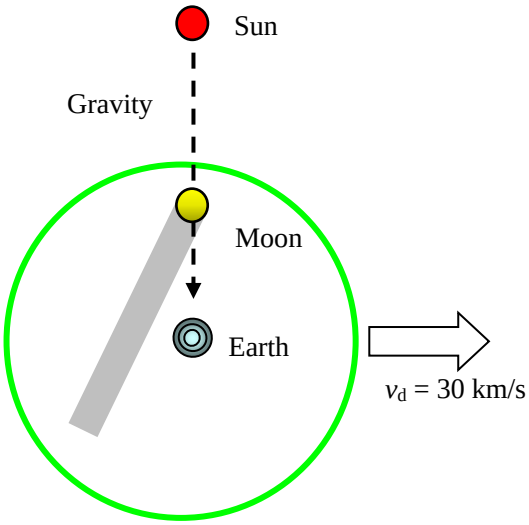


Fig. 17 After 38 ± 1.9 seconds from total eclipse, the Sun and Moon's gravitational forces align occurs.

11.2 Gravitational force and gravitational waves

Van Flandern and Viger[47] explained gravitational force and gravitational waves by anchor-buoy model as shown in **Fig. 18**. Gravitational force is anchor and chain pulling on buoy, and gravitational waves are water ripples emerging form buoy.

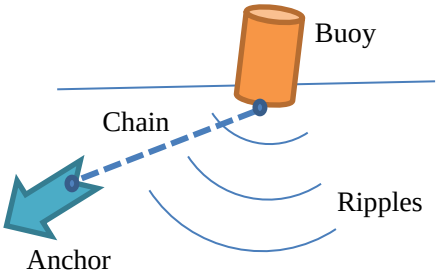


Fig. 18 Anchor-buoy model by Van Flandern and Viger[47]

11.3 Gravity entanglement[48]

Gravity entanglement is similar to the anchor-buoy model. The distribution of the ether density from a point mass simultaneously moves with the point mass as shown in **Fig.19**; this is gravity entanglement.

We assume that point mass deceleration causes not only Bremsstrahlung but also gravitational waves (acoustic waves in the ether). Bremsstrahlung is the radiation of adhered photons of point mass. The motion of point mass generates a compressional fluctuation of ether density which travels at the speed of light, this is gravitational waves.

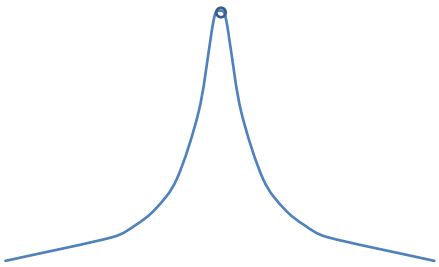


Fig.19 Ether density distribution from point mass simultaneously moves with the point mass. At the same time, the fluctuation travels at the speed of light c, as gravitational waves.

Let us assume the elastic modulus of the ether is K_E, the density of the ether is ρ_E, the speed of gravitational wave is c, and the distance from the point mass is r. Therefore,

$$\sqrt{\frac{K_E}{\rho_E}} = c(r) = \frac{1}{\sqrt{\varepsilon_0 \mu_0}}. \quad (8)$$

Thus, we obtain,

$$\rho_E(r) = K_E \varepsilon_0 \mu_0. \quad (9)$$

Gravity g is caused by the gradient of the distribution of the ether density ρ_E as,

$$g = M \frac{\partial \rho_E}{\partial r}. \quad (10)$$

Where M is the mass of the earth. The ether density distribution, as shown in **Fig. 19**, is assumed to be an exponential function[6],

$$\rho_E(r) = G(1 - e^{-\frac{1}{r}}). \qquad (11)$$

Substitute equation (11) into equation (10), thus, we obtain,

$$g = M\frac{d\rho_E}{dr} = -GM\frac{d}{dr}e^{-\frac{1}{r}} = \frac{GM}{r^2}e^{-\frac{1}{r}}. \qquad (12)$$

Equation (12) shows that gravity g approaches to $\frac{GM}{r^2}$ at r≫0, furthermore excludes the gravitational singularity at r = 0; that is, g = 0 not ∞ at r = 0. **Figure 20** shows gravity from the point mass calculated using equation (12).

The distribution of the ether density simultaneously moves with the point mass as shown in **Fig. 19**. The distribution overlaps over that of another point mass to cause attraction at a distance; this is gravity entanglement[6]. We assume that point mass deceleration causes not only Bremsstrahlung but also gravitational waves[7]. The motion of point mass generates a compressional fluctuation of ether density which travels at the speed of light, this is gravitational waves.

Quantum entanglement is accepted because it does not transfer any information, therefore, gravity entanglement has a possibility of acceptance because there is no information transmission.

Quantum entanglement disappears with interaction of another system. We discussed the continuity of quantum entanglement[49]. Gravity entanglement is considered to permanently continue.

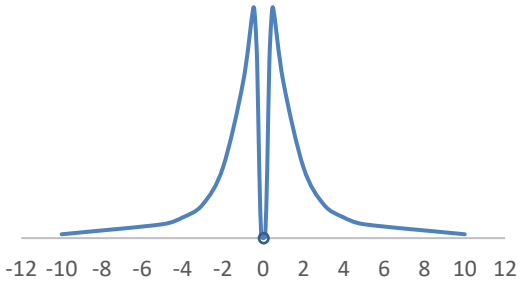


Fig. 20 Gravity from the point mass

Eddington[36] discussed the motion of the Sun and Jupiter as shown in **Fig. 21** noting that "If the Sun attracts Jupiter towards its present position S, and Jupiter attracts the Sun towards its present position J, the two forces are in the same line and balance. But if the Sun attracts Jupiter toward its previous position S', and Jupiter attracts the Sun towards its previous position J', when the force of attraction started out to cross the gulf, then the two forces give a couple. This couple will tend to increase the angular momentum of the system, and, acting cumulatively, will soon cause an appreciable change of period, disagreeing with observations if the speed is at all comparable with that of light. The argument is fallacious, because the effect of propagation will not necessarily be that S is attracted in the direction towards J'. Indeed it is found that if S and J are two electric charges, S will be attracted very approximately towards J (not J') in spite of the electric influence being propagated with the velocity of light." It is considered that Eddington[36] was already aware that the gravity is an entanglement.

Using the discussion by Eddington[36], Van Flandern and Viger[47] first proposed the idea of gravity entanglement. Van Flandern[20] noted that "Yet, anyone with a computer and orbit computation or numerical integration software can verify the consequences of introducing a delay into gravitational interactions. The effect on computed orbits is usually disastrous because conservation of angular momentum is destroyed."

Van Flandern[20] wrote that Eddington[36] was already aware of the mostly equivalent "refracting medium" explanation for general relativistic (GR) features, which retains Euclidean space and time in the same mathematical formalism. "In essence, the bending of light, gravitational redshift, Mercury perihelion advance, and radar time delay can all be consequences of electromagnetic wave motion through an underlying refracting medium that is made denser in proportion to the nearness of a source of gravity." And "The principal objection to this conceptually simpler refraction interpretation of GR is that a faster-than-light propagation speed for gravity itself is required."

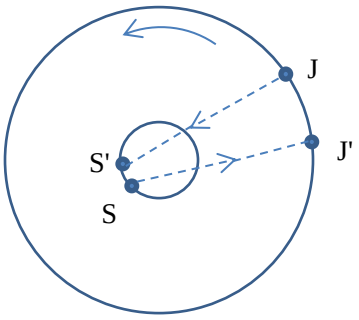


Fig. 21 Copy from Eddington's[36] book (P. 84, FIG. 13)

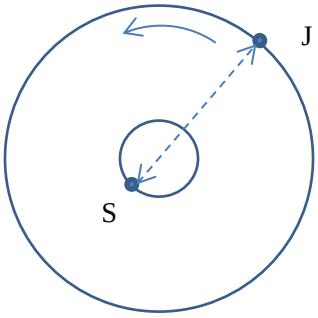


Fig. 22 Newton's gravity entanglement model (r)

Quantum entanglement started from the conservation of spin. Thus, gravity entanglement started from the conservation of angular momentum. The Sun and Jupiter rotate around the barycenter satisfying the conservation of angular momentum. We consider that the conservation of angular momentum derives gravity entanglement. We consider Newton's gravity entanglement model in **Fig. 22** is correct.

12. Gravitational wave

From Wikipedia it is noted that "Gravitational waves are disturbances in the curvature of spacetime, generated by accelerated masses, that propagate as waves outward from their source at the speed of light." We consider that the gravitational wave is an acoustic wave in the ether[50].

12.1 Refutation of the disturbances in the curvature of spacetime

Perlmutter[51] noted that "the cosmic expansion stretches not only the distances between galaxy clusters but also the very wavelengths of the photons en route." I do not consider that this notation is right. However, if it is right, in the Michelson interferometer experiment of the Laser Interferometer Gravitational-Wave Observatory (LIGO), we cannot observe a curvature of spacetime. This is because wavelengths are changed to cancel the disturbances in the curvature of spacetime.

12.2 Gravitational wave derived from fluid mechanics

In this section we introduce an idea that gravitational wave is an acoustic wave in the ether[50]. Let us assume the elastic modulus of the ether is K_E, the density of the ether is ρ_E, and the speed of gravitational wave is c. Therefore, $\sqrt{\frac{K_E}{\rho_E}} = c(x) = \frac{1}{\sqrt{\varepsilon_0\mu_0}}$. Thus, we obtain $\rho_E(x) = K_E\varepsilon_0\mu_0$. The gravitational wave is the fluctuation of the ether density ρ_E.

Let us derive the gravitational wave. To simplify the discussion, it is carried out with one dimension. According to the analogy of acoustic wave, let us use three equations; equation (13) shows the Euler's equation of motion, in which the gradient of gravity causes ether motion toward the high ether density region, where p_g is the pressure of gravity. Equation (14) is the equation of continuity of the ether and equation (15) is that of adiabatic processes (Boyle's law). The fluctuation of gravity is proportional to that of the ether.

$$\rho_E\left(\frac{\partial v}{\partial t} + v\frac{\partial v}{\partial x}\right) = \frac{\partial p_g}{\partial x} \qquad (13)$$

$$\frac{\partial \rho_E}{\partial t} + \frac{\partial}{\partial x}(\rho_E v) = 0 \qquad (14)$$

$$\frac{p_g}{\rho_E} = Constant \qquad (15)$$

Equations (13) ~ (15) define the acoustic waves in the ether. This is the gravitational waves. For linearization, separate the parameters to the constants and variances. The subscript 0 shows constant, and that of 1 shows variance; thus subscript 1 indicates the fluctuation of the gravitational wave.

$\rho_E = \rho_0 + \rho_1$, $v = v_0 + v_1$, $p_g = p_0 + p_1$

And assuming $\rho_0 \gg \rho_1$, $p_0 \gg p_1$ to linearize equations (13) ~ (15), we obtain,

$$\rho_0\left(\frac{\partial v_1}{\partial t} + v_0\frac{\partial v_1}{\partial x}\right) = \frac{\partial p_1}{\partial x} \qquad (16)$$

$$\frac{\partial \rho_1}{\partial t} + \rho_0\frac{\partial v_1}{\partial x} + v_0\frac{\partial \rho_1}{\partial x} = 0 \qquad (17)$$

$$\frac{p_1}{\rho_1} = -\frac{K_E}{\rho_0} \qquad (18)$$

Equation (18) is purposely assumed to make the phase velocity becomes the speed of light c.

Let us assume that the fluctuations vibrate according to equation (19),

$$\begin{aligned} v_1 &= \widetilde{v_1} expi(kx - \omega t) \\ p_1 &= \widetilde{p_1} expi(kx - \omega t + \emptyset_1) \\ \rho_1 &= \widetilde{\rho_1} expi(kx - \omega t + \emptyset_2) \end{aligned} \qquad (19)$$

where, $\omega = 2\pi f$ (f: frequency) is the angular frequency, $k = \frac{2\pi}{\lambda}$ (λ: wavelength) is the wave number, and ϕ is the phase. Inserting equation (19) into equations (16) to (18), we obtain,

$$-i\omega\rho_0 v_1 + ik\rho_0 v_0 v_1 = ikp_1$$
$$-i\omega\rho_1 + ik\rho_0 v_1 + ikv_0\rho_1 = 0$$
$$p_1 = -K_E\frac{\rho_1}{\rho_0}$$

Thereafter, arranging these equations into matrix,

$$\begin{pmatrix} i\omega\rho_0 - ik\rho_0 v_0 & ik & 0 \\ ik\rho_0 & 0 & -i\omega + ikv_0 \\ 0 & 1 & -\frac{K_E}{\rho_0} \end{pmatrix}\begin{pmatrix} v_1 \\ p_1 \\ \rho_1 \end{pmatrix} = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}$$

At the condition that the system of linear equations has non-zero solutions set of v_1, p_1, and ρ_1, it will propagate as a gravitational wave. This condition is derived from the determinant of coefficients set 0; this shows the dispersion relation of the gravitational wave as,

$$\frac{\omega}{k} = v_0 \pm \sqrt{\frac{K_E}{\rho_0}} = v_0 \pm c$$

Where, v_0 is the drift velocity of the ether. Let us set $v_0 = 0$, thus, the phase velocity of gravitational wave is the speed of light c; this is because we purposely assume equation (18) for adiabatic processes.

Not only transverse waves (electromagnetic waves) but also longitudinal waves (acoustic waves) have the phase velocity of the speed of light c. The LIGO can observe the acoustic waves in the ether rather than the curvature of spacetime.

13. Refutation of the big bang

There are many arguments against the big bang. Van Flandern[52] presented a list of problems with the Big Bang.

Selleri[53] refuted the big bang model noting that "The model is built on the four dimensional space of general relativity, in turn based on the Minkowski space of special relativity which is entirely dependent on the Lorentz transformation of time." We refuted relativity, Minkowski's spacetime and Lorentz transformation.

In the next sections using experimental results of supernova and quasar, we refute the big bang.

13.1 Hubble's discovery

Hubble initially accepted a finite expanding universe, but later on, he turned to an infinite stationary universe and a new principle of nature to explain the redshifts.

Perlmutter[53] noted that "In Edwin Hubble's discovery of the cosmic expansion in the 1920s, he used entire galaxies as standard candles." However, Hubble, contrary to the statements of many modern authors, did not accept the expanding universe theory. Expansion is a theoretical idea of the de Sitter model. Hubble's observations are not necessarily proof of an expanding universe. Hubble remained cautiously against the big bang.

13.2 An alternative interpretation of the accelerating universe: refutation of dark energy

In this section, we refute expanding universe. Let us look back redshift and light curve width relations. In the expanding universe, it is considered that redshift z and light curve width w are proportional. This is explained that space expansion stretches both wavelength and distances of photons en route. Distances between photons are stretched, that is, the light curve widths w increase. However, wavelengths are not stretched but are velocity redshifted.

Let us show magnitude redshift and light curve width relations of type Ia supernovae using the experimental data by Perlmutter[54] et al. and Goldhaber[55] et al. In this figure, as Hubble did, we consider the magnitude to correspond to the distance from the earth. (Hubble[56], p. 169, FIG. 14) **Figure 23**[57] shows that at magnitudes of approximately 14~20 the light curve widths do not show the effects of time dilation. These data do not appear to show the accelerating universe. The upper figure shows low-z only, where widths decrease with increasing magnitude (m_B). The lower figure shows all supernovae, and in this case light curve width slowing appears. **Figure 24** shows magnitude-redshift and light curve width relation of type Ia supernovae (magnitude 20 to 25) in linear scale, which shows $w=1+z$. The universe has not expanded in the last 1.3 billion years.

13.3 Tired light by Zwicky

We propose Zwicky's tired light mechanism to explain the redshift. In 1929, Zwicky[58, 59] explained the redshift of spectral lines through interstellar space using the "tired light" model, which is a class of hypothetical redshift mechanisms proposed as an explanation for the redshift-distance relationship. Zwicky[58] proposed that a gravitational "drag" acts on light—that is, a light quantum loses its energy in the gravitational fields of nebulae, causing its frequency to decrease. Zwicky[58] noted that "It should be expected, therefore, that a quantum $h\nu$ passing a mass M will not only be deflected but not it will also transfer momentum and energy to the M and to mass make it recoil."

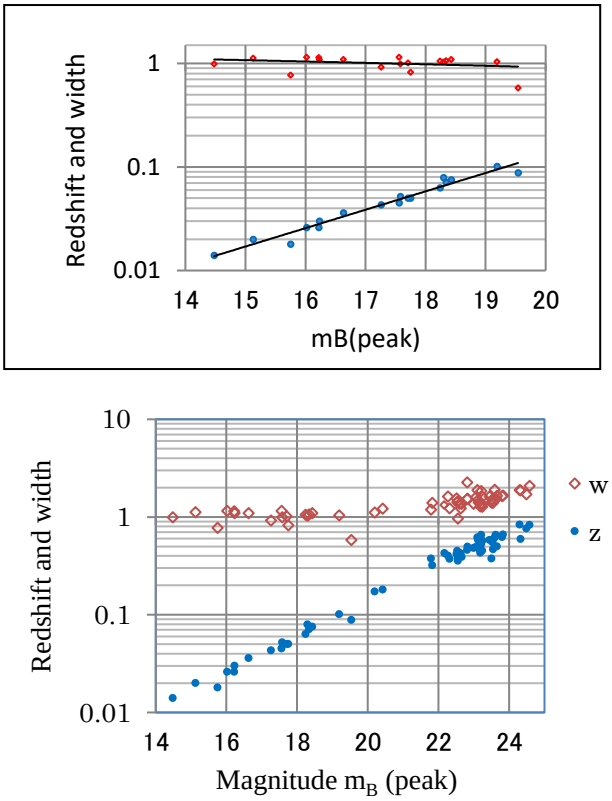


Fig. 23 Magnitude-redshift and light curve width relation of type Ia e using the experimental data by Perlmutter[54] et al. and Goldhaber[55] et al.

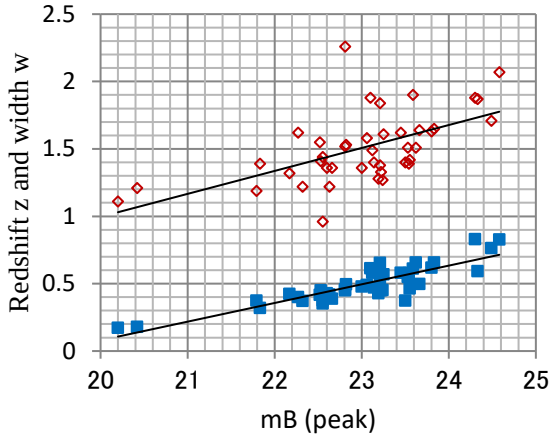


Fig. 24 Magnitude-redshift and light curve width relation of type Ia supernovae (magnitude 20 to 25) using the experimental data by Perlmutter[53] et al. and Goldhaber[54] et al.

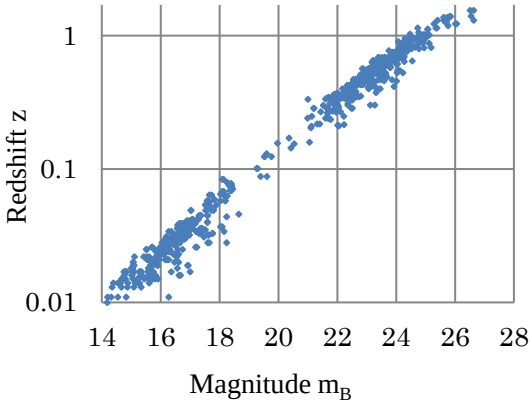


Fig. 25 Magnitude-redshift relation of type Ia supernovae using the experimental data (tables 1 and 2) by Hicken[61] et al. The fluctuation of supernovae appears.

13.4 Refutation of the expanding universe

Hawkins[60] reported on "over 800 quasars monitored on timescales from 50 days to 28 years to construct Fourier power spectra for high and low redshift samples," and concluded that "quasar light curves do not show the effects of time dilation." He noted that "there is however surprisingly little direct evidence that the Universe is expanding." He also noted that "the large body of observations of quasar host galaxies seems to rule out the possibility that quasars are nearby and that as a result time dilation would be negligible."

Magnitude-redshift and light curve width relation of type Ia supernovae (magnitude 14 to 20) do not show that the Universe is expanding. At magnitude 20 to 25, the Universe looks expanding. From experimental date of time dilation in quasar light curves, the Universe is not expanding. That is, at $z > 1$, the Universe is not expanding.

Figure 25 shows a magnitude-redshift relation of type Ia supernovae using the experimental data by Hicken[61] et al. which shows the fluctuation of supernovae. There was a sparse period of supernovae density at approximately z = 0.08 to 0.2, m_B = 19 to 21. **Figures 23** shows that at low z (< 0.1), the light curve width *w* is constant. At high z (> 0.1), the light curve width *w* is proportional to 1+z. The sparse period of supernovae appears to be a point where the inclination of light curve width changes in **Fig. 23**.

13.5 Refutation of the big bang

As shown in section 13.2, at m_B = 14~20 ($z < 0.1$) there is no expansion. At m_B = 20~25 ($0.2 < z < 0.9$), there is expansion. In section 13.3, experimental results showed that at $z > 1$, the Universe is not expanding. Therefore, we conclude that the big bang is refuted.

14. Alternative theory and experimental proposal

14.1 An alternative theory of relativity

Physics, especially cosmology should be free from relativity. An alternative theory of relativity is the ether theory that was discussed at least in the early 20th century.

Dirac[62] described in 1951 that "Physical knowledge has been advanced very much since 1905, notably by the arrival of quantum mechanics, and the situation has again changed. If one reexamines the question in the light of present-day knowledge, one finds that the aether is no longer ruled out by relativity, and good reasons can now be advanced for postulating an aether." Fiennes[63] summarized the ether and the history of the ether.

The property of ether is the permittivity ε_0, and the permeability μ_0. It is time to study the ether.

14. 2 Proposal of experiments in the International Space Station

Equation (13) shows the Coulomb's law.

$$F = \frac{q_1 q_2}{4\pi\varepsilon_o r^2}. \qquad (20)$$

The CODATA value in 2019 of the permittivity[64] of free space is $\varepsilon_0 = 8.8541878128(13) \times 10^{-12}$ F·m^{-1} (farads per meter).

I will try to propose an experiment aboard the ISS: the measurement of the permittivity and permeability of free space in 9% small gravity with weightlessness condition.

15. Summary

Table 1 summarizes refuted terms in the theory of relativity. Table 2 shows unexplained phenomena by the theory of relativity.

Table 1 Refuted terms in the theory of relativity

	Refuted terms	References
1	The principle of relativity	Phipps[1], Sato[2]
2	The constancy of the speed of light	Gift[25], Sato[28]
3	Lorentz transformation	Gift[17]
4	Relative simultaneity	Gift[17]
5	Support from Maxwell equations	Hertz[29], Phipps[14]
6	Support from quantum mechanics	Lévy-Leblond[34]

Table 2 Unexplained phenomena by the theory of relativity

	Unexplained phenomena	References
1	GPS clocks variation	Sato[28]
2	Aberration	Van Flandern[32], Sato[27]

16. Conclusion

The ether theories were revisited. The ether theory covers relativity theory; one of exception is aberration. We showed that aberration cannot be explained by relativity theory, however, the ether theory can. Both the special and general relativity theories were refuted from the viewpoints of physics and mathematics. Physics should be free from relativity and back to the ether theory. It is time to reexamine the property of ether; the permittivity and permeability of free space should be examined.

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