Ritz Is Wrong

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Abstract
Ritz postulated that all action and light proceed with velocity c with respect to the moving source. A review of the evidence against this Ritz theory is presented here. The variability of distant stellar sources, such as Cepheid variables and pulsars, could not be observed if Ritz were right.

Key words: light, velocity c relative to source, Ritz, ballistic theory

1. THE RITZ THEORY

The Ritz[1] theory for light, the so-called ballistic theory, postulates that the velocity of light partakes of the velocity of the moving source; the observed velocity of light $\mathbf{c}^*$ is then given by

$$\mathbf{c}^* = \mathbf{c} + \mathbf{V} = \mathbf{c} + \mathbf{v}(\text{source}) - \mathbf{v}(\text{observer}), \qquad (1)$$

where $\mathbf{V}$ is the relative velocity between source and observer and $\mathbf{c}$ is the velocity of light observed when $\mathbf{V}$ is zero. The Ritz theory has been accepted by many, such as Dingle,[2] Waldron,[3] and O'Rahilly.[4] Objections to the Ritz theory have been presented over the years by such authors as De Sitter[5] and Fox.[6] The present paper presents only a brief review of the current more significant evidence against the Ritz theory. It is often presumed to be an alternative to "special relativity," but "special relativity" may be readily shown to be wrong quite apart from the Ritz theory (e.g., Galeczki and Marquardt[7]).

2. THE RITZ THEORY VIOLATES THE SPACE-TIME PRINCIPLE

The Ritz theory presumes the possibility of infinite velocities for massive bodies. According to Ritz, a body moving with a velocity of almost c could, in principle, produce an action with a velocity of almost $2c$ to accelerate a second body to almost $2c$, which, in turn, could, in principle, produce an action with a velocity of almost $3c$, etc. Thus the Ritz theory permits, in principle, bodies with no restriction nor upper limit to their velocities. This is impossible: If all velocities were equally likely, as implied by the Ritz theory, large numbers being more likely than small numbers, the stars should be seen to be rushing about like fireflies. Yet the distant stars on the celestial sphere all appear to be fixed in position, which can only be explained if there is a universal common finite cosmological limit velocity for all bodies in the universe.

This cosmological limit velocity must be c; since the neomechanical momentum of a body of mass m, $\mathbf{p} = m\gamma\mathbf{v} = m\mathbf{v}/(1 - v^2/c^2)^{1/2}$, where for a *unique* value of $\mathbf{p}$ the velocity $\mathbf{v}$ must be the *unique absolute* velocity of the body (Wesley[8–10]), would become infinite if v were to equal c. The Ritz theory prescribes no such *local* principle that would restrict in any way the velocities of massive bodies. Thus, the Ritz theory, violating the principle that all momentum and thus action must be carried with absolute velocities less than or equal to c, is wrong.

3. LABORATORY OBSERVATIONS PROVING RITZ IS WRONG

3.1 The Tomaschek[11] Variation of the Michelson–Morley Experiment

The Ritz theory explains the Michelson–Mor1ey[12] null result, when the light source and the Michelson interferometer are both fixed in the moving laboratory. In this case the relative velocity $\mathbf{V}$, in (1), is always zero. According to the Ritz theory, (1), the observed velocity of light $\mathbf{c}^*$ will always be $\mathbf{c}$ no matter what the absolute velocity of the laboratory might be, thereby explaining the null Michelson–Morley result.

To check the Ritz theory and to determine the effect of a moving light source on the Michelson–Morley result, Tomaschek repeated the Michelson–Morley experiment using light from a moving star. In this case the relative velocity $\mathbf{V}$ between the source and the Earth laboratory is no longer zero. According to the Ritz theory, Tomaschek should have obtained a positive result, but he again obtained a null result, thereby indicating that Ritz is wrong.

3.2 The Sagnac[13] Experiment Reveals Ritz Is Wrong

Light from a source mounted on a turntable is split into two beams that travel around an area A on the turntable with the appropriate use of mirrors in opposite directions to then form an interference pattern. When the turntable is rotated with angular velocity Ω, the interference pattern is observed to shift such that the beam traveling in the direction of rotation takes longer to arrive at the point of interference than the beam traveling counter to the direction of rotation. The net optical path difference D is then found to be given by

$$D = \frac{4\Omega A}{c}. \tag{2}$$

This result is trivially explained if the velocity of light is assumed to be $\mathbf{c}$ with respect to absolute space or with respect to a fixed luminiferous ether (as assumed by Sagnac) and independent of the velocity of the moving source. No parts of the apparatus on the turntable are in relative motion with respect to each other; so the observed effect can only be produced by the turntable rotating with respect to absolute space or with respect to the luminiferous ether. Since the relative velocity $\mathbf{V}$ between source and detector is zero in this case, the interference pattern, according to Ritz, (1), should remain the same whether the turntable is rotated or not. Since the Sagnac effect is, in fact, observed, Ritz is wrong.

The observations of Roemer,[14] Bradley,[15] Conklin,[16] and others[17] demonstrate that the observed velocity of light $\mathbf{c}^*$ is given by

$$\mathbf{c}^* = \mathbf{c} - \mathbf{v}(\text{observer}), \tag{3}$$

and not by (1), where $\mathbf{c}$ is the velocity of light with respect to absolute space or the fixed luminiferous ether.

3.3 The Marinov[18,19] Experiments Reveal Ritz Is Wrong

Marinov compared the one-way velocity of light from two independent sources traveling in opposite directions to obtain the absolute velocity of the closed laboratory $\mathbf{v}$ using (3); thus

$$\mathbf{v} = \frac{\mathbf{c}_-^* - \mathbf{c}_+^*}{2} \tag{4}$$

(as reviewed by Wesley[20]). Since both the sources and the detectors are fixed in the laboratory, the relative velocities between sources and detectors $\mathbf{V}$ are zero. According to Ritz, in (1), both of the velocities $\mathbf{c}_-^*$ and $\mathbf{c}_+^*$ should equal $\mathbf{c}$, and Marinov should have obtained no result. Yet Marinov obtained the absolute velocity of the closed laboratory: the absolute velocity of the solar system of about 300 km/s plus the velocity of Earth in orbit around the Sun of about 30 km/s. His results, accurate to at least two places, agree with other estimates.[16,17] The Ritz theory, not predicting these results, is wrong.

3.4 Experiments with Moving Mirrors

To achieve fast light sources to test the Ritz theory, many ingenious experiments[21–27] have been performed using mirrors. No change in the observed velocity of light has been thereby detected as a function of the velocity of the source, as required by the Ritz theory. Although this direct evidence against the Ritz theory is impressive, the experimental uncertainties may not permit these results to be regarded as decisive. However, there is ample other evidence against the Ritz theory that is decisive. Ad hoc assumptions about the behavior of the velocity of light upon reflection from a moving mirror have been proposed to try to rescue the Ritz theory, but they are insufficient to explain all of the situations where the Ritz theory fails.

3.5 Velocity of Gamma Rays Is Independent of the Velocity of the Source

Alväger et al.[28] have demonstrated that the velocity of gamma rays (and thus light) from rapidly moving radioactive particles is independent of the high velocity of the radioactive particles, which refutes the Ritz theory.

4. ASTRONOMICAL OBSERVATIONS REFUTING RITZ

4.1 Velocity of Light Is Independent of the Velocity of the Limbs of the Sun

Tolman,[29] Bonch-Bruevich and Molchanov,[30] and Beckmann and Mandics[31] could find no difference in the velocity of light due to the approaching and receding velocities of the limbs of the rotating Sun using a Lloyd's mirror. They could not confirm the Ritz theory.

4.2 Bradley Stellar Aberration Is Independent of Stellar Velocities

If the Ritz theory, (1), were correct, then the angle of stellar aberration β would be given by

$$\sin\beta = \frac{\mathbf{v}_0}{|\mathbf{c}+\mathbf{v}_s|}\sin\theta, \tag{5}$$

where θ is the apparent angular position of a star with respect to the forward absolute velocity of the observer $\mathbf{v}_0$, $\mathbf{c} + \mathbf{v}_s$ is the velocity of the incident light according to Ritz, and $\mathbf{v}_s$ is the velocity of the stellar source. Assuming the velocity of light is simply $\mathbf{c}$ relative to absolute space, the classical Bradley aberration formula[32] for the aberration angle β_0 is

$$\sin\beta_0 = \frac{\mathbf{v}_0}{\mathbf{c}}\sin\theta. \tag{6}$$

All stars observed in the same direction are found to have precisely the same angle of aberration. For stars normal to the ecliptic, where θ = 90°, the observed angle of aberration for all stars is found to be 20.22″. Comparing (5) and (6) for v_0/c and v_s/c small, the Ritz theory predicts a departure from this classical angle given by

$$\Delta\beta = \beta_0 - \beta = \frac{v_0(\mathbf{c}\cdot\mathbf{v}_s)}{c^3} = (20.22'')\left(\frac{\mathbf{c}\cdot\mathbf{v}_s}{c^2}\right). \tag{7}$$

In the search for proper motion of stellar objects, photographs taken at different times are superimposed and surveyed for any possible minute relative change in position of any stellar object. A star whose relative position with respect to other stars changes after 6 months would be interpreted as having a proper motion. Thus, if the relative change indicated by (7) were large enough, it would be detected during the search for stars with proper motion. The velocities of galaxies in the Coma Cluster have been estimated to be of the order of 2000 km/s (neglecting any mythical velocity of expansion of the universe). Substituting this velocity of 2000 km/s into (7), the apparent relative angular displacement of such a galaxy after 6 months would be on the order of

$$\Delta\beta = (20.22'')(6.67\times10^{-3}) = 0.135''. \tag{8}$$

Such a relative displacement would have been readily noticed in the search for proper motion, if it existed. No such strange apparent annual proper motions have ever been observed, so Ritz is wrong.

4.3 The Observation of Variable Stars Refutes Ritz

A gaseous incandescent light source possesses radiating atoms and molecules that have a spread in thermal velocities. The radiation from such sources depends upon the velocities of the individual atoms and molecules as evidenced by a Doppler spreading in the spectral lines radiated. According to the Ritz theory, atoms or molecules moving toward the observer emit photons that arrive earlier than photons radiated at the same time from atoms and molecules moving away from the observer. A signal involving the entire incandescent source should then arrive at an observer a distance D from the source as a signal spread out in time given by

$$\Delta t(\text{Ritz}) \cong \frac{D}{c-v} - \frac{D}{c+v} \cong 2\frac{Dv}{c^2}, \tag{9}$$

where v may be chosen as some mean thermal speed for the radiating atoms or molecules, which may be assumed to be small compared with c. According to the kinetic theory of gases, the mean velocity may be chosen as the root mean square (rms) velocity given by[33]

$$v(\text{rms}) = \sqrt{\frac{3kT}{m}}, \tag{10}$$

where T is the absolute temperature of the source, m is the mass of a radiating atom or molecule, and k = 1.380×10^{-23} J/°K is Boltzmann's constant.

Light from a stellar source radiating with a variable period P with a temperature T a distance D from Earth could not be detected as a variable source if the spreading of arrival times predicted by the Ritz theory, (9) and (10), were greater than the period of the variation; thus, if

$$\Delta t(\text{Ritz}) \cong 2\frac{Dv}{c^2} > P \quad \text{or} \quad \frac{P}{D} < \frac{2v}{c^2}, \tag{11}$$

then the source would appear to radiate continuously with no time variation P, according to Ritz.

The temperature of a typical stellar source may be taken as the temperature of the Sun's surface of 5700°K. Using (10), a few typical thermal rms molecular speeds for this temperature are, for H_2, 8.43

km/s; for He, 5.96 km/s; for C, 3.44 km/s; and for O_2, 2.11 km/s. Considering a typical modest thermal speed of 2 km/s for a radiating atom or molecule in a visual stellar object, condition (11) says that the Ritz theory fails if variations are observed even when

$$\frac{P}{D} < 1.4\times10^{3} \text{ s/pc}, \qquad (12)$$

where P is in seconds and D is in parsecs (pc).

For a pulsating star with a period of 1 day, P = 86400 s, (12) says that no variations could be observed beyond a distance D of 62 pc if Ritz were right. Since 62 pc from Earth includes only a local region containing about $\sim10^{-4}$ of the volume of the entire readily observable volume of the Milky Way and since Cepheid variables varying with a period on the order of 1 day are observed throughout the Milky Way, the Ritz theory, permitting only a vanishing percentage of these Cepheid variables to be detected, is clearly wrong. Long-period Cepheids with periods on the order of 5 days should not be seen, according to Ritz, (12), beyond a distance D of 30 pc, which then would exclude most of the long-period Cepheids actually seen. Many hundreds of long-period Cepheids are observed in the Small Magellanic Cloud at a distance of 50 kpc, which is a distance of about 160 times farther than the maximum distance at which such Cepheids should be observed, according to Ritz. Clearly Ritz is wrong.

The failure of the Ritz theory becomes even more drastic when visual pulsars are considered with period on the order of 2 s, which, according to the Ritz theory, (12), should only be observable at distances less than 0.0014 pc. Of the approximately 500 pulsars now seen, the closest is at a distance of about 100 pc, which means that, according to Ritz, no pulsar at all should be observed with a period of 2 s or less. The pulsar in the Crab Nebula, which has a period of 33 ms, is at a distance of 1.3 kpc. Consequently, the Ritz theory, (12), fails by the huge factor of 5.6×10^9 to permit this observed pulsar to be, in fact, observed.

In addition, there are pulsating sources with radiating atoms with thermal velocities orders of magnitude greater than the modest 2 km/s considered above, such as in X-ray pulsars. The Ritz theory fails utterly to explain the observations of such exotic pulsating sources.

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Résumé

Ritz postule que toutes les actions et la lumière agissent avec la vitesse c relatif à la source en mouvement. Une revue de l'évidence contre la théorie de Ritz est présentée ici. La variabilité des sources stellaires distantes, tel que les variables Céphéide et les pulsars ne pourraient être observée si Ritz avait raison.

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