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Translational movement of the light ether

[i]

On the questions concerning the translational movement of the light ether;

(Representation for the 70th meeting of German natural scientists and doctors in Düsseldorf, 1898; Section Physics.)

The question of whether the light ether ether takes part in the movements of bodies or not, and whether mobility can be at it at all, has occupied physicists for a long time and there countless assumptions and conjectures that one has to make about the properties of the carrier of electromagnetic phenomena held.However, there can be no doubt that everything we know about the ether is contained inMaxwell's theory of electromagnetism and everything else belongs to the realm of pure speculation.Accordingly, I have not set myself the task of providing a literary report on the innumerable theories that have the light ether as their subject, but have endeavored to highlight the questions that we have to answer on the basis of the basis ofMaxwell's theory regarding the mobility of the ether.

If we make the assumption that the ether has mobility, further questions immediately arise, namely whether this movement requires energy expenditure, i.e. whether the ether is to be attributed inert mass, and then whether the ether the ether is also set in motion by the movement of solid bodies .The latter does not appear to be the caseaccording to many experiments, especially after the extensive experiments ofLodge , which were carried out with rapidly rotating metal masses or in the vicinity of high-speed circular saws.

We will first compare the assumptions as to whether mobility can be attributed to the ether or not and then move on to the discussion of the empirical facts.

[ii]

The assumption of the mobility of the aether.

The tendency to bring the properties of the ether into agreement with those of ponderable matter has led to the assumption that the ether can carry out movements in the manner of a liquid, although not a single experiment indicates the existence of such movements.But if one

ascribes mobility to the ether, then, asH e r t z first noted, it follows strictly fromM a x w e l l 's theory that under the influence of the pressure forces generated by a variable electromagnetic system, it must carry out movements that can be calculated, if one makes certain assumptions about the inertia of the ether.

H e l m h o l t z gave the basic principles for the calculation of these flows under the assumption that the inertia and compressibility of the aether is zero.However, he did not give any specific examples that would allow this theory to be tested against experience, and I will therefore give two examples from which some conclusions can be drawn as to the meaning of these assumptions.

Currents in the ether are only excited by electromagnetic tensions when the field is neither static nor stationary, i.e. when the conditions of time are still change variable.

As a first example I introduce an electrified colon, which carries equal quantities of positive and negative electricity at a very small distance from each other, which increase proportionally with time.

If we designate the coordinates with *, y, z,the*timewitht,the components of the electricalforces*with*Maxwell' s differential equations

$$A\frac{dL}{dt} = \frac{\partial Z}{\partial y} - \frac{\partial Y}{\partial z} \qquad A\frac{dX}{dt} = \frac{\partial M}{\partial z} - \frac{\partial N}{\partial y}$$

$$A\frac{dM}{dt} = \frac{\partial X}{\partial z} - \frac{\partial Z}{\partial x} \qquad A\frac{dY}{dt} = \frac{\partial N}{\partial x} - \frac{\partial L}{\partial z}$$

$$A\frac{dN}{dt} = \frac{\partial Y}{\partial x} - \frac{\partial X}{\partial y} \qquad A\frac{dZ}{dt} = \frac{\partial L}{\partial y} - \frac{\partial M}{\partial x}$$

$$\frac{\partial L}{\partial x} + \frac{\partial M}{\partial y} + \frac{\partial N}{\partial z} = 0 \quad \frac{\partial X}{\partial x} + \frac{\partial Y}{\partial y} + \frac{\partial Z}{\partial z} = 0.$$

[**iii**] We satisfy these equations using the following expressions:

$$X = \frac{\partial^2 \varphi}{\partial z\, \partial x} \qquad L = -A\frac{\partial^2 \varphi}{\partial y\, \partial t}$$

$$Y = \frac{\partial^2 \varphi}{\partial z\, \partial y} \qquad M = A\frac{\partial^2 \varphi}{\partial x\, \partial t}$$

$$Z = \frac{\partial^2 \varphi}{\partial z^{\,2}} \qquad N = 0.$$

Let a be*a*constant and$r^2 = x^2 + y^2 + z^2$,$\varrho = x^2 + y^2$,$\varphi = at/r$.The components of the electrical forces are then the partial derivatives of the function

$$at\frac{\partial}{\partial z}\left(\frac{1}{r}\right).$$

This is the potential of an electric colon in the point$r = 0$with the positive and negative charge

at/l.The line connecting both charges$l$is parallel to the$z$-axis.The components ofP o y n t i n g 's energy flow are proportional to the quantities

$$\mathfrak{P} = ZM - YN = Aa^2tx\left(\frac{1}{r^6} - \frac{3z^2}{r^8}\right)$$

$$\mathfrak{Q} = XN - ZL = Aa^2ty\left(\frac{1}{r^6} - \frac{3z^2}{r^8}\right)$$

$$\mathfrak{R} = YL - XM = 3Aa^2tz\frac{x^2+y^2}{r^8}.$$

Now let's set

$$x = \varrho\cos\vartheta \qquad y = \varrho\sin\vartheta \qquad \frac{dx}{dt} = \alpha = \frac{d\varrho}{dt}\cos\vartheta - \varrho\sin\vartheta\frac{d\vartheta}{dt}$$

$$\frac{d\vartheta}{dt} = \eta \qquad \frac{d\varrho}{dt} = \zeta \qquad \frac{dy}{dt} = \beta = \frac{d\varrho}{dt}\sin\vartheta + \varrho\cos\vartheta\frac{d\vartheta}{dt}$$

$$\frac{dz}{dt} = \gamma,$$

thus demands the equation of incompressibility

$$\frac{\partial\alpha}{\partial x} + \frac{\partial\beta}{\partial y} + \frac{\partial\gamma}{\partial z} = 0,$$

that

$$\alpha = \frac{\partial\psi}{\partial z}\frac{x}{\varrho^2} - \eta y \quad \beta = \frac{\partial\psi}{\partial z}\frac{y}{\varrho^2} + \eta x \quad \gamma = -\frac{1}{\varrho}\frac{\partial\psi}{\partial\varrho}$$

is, if we assume that because of the symmetry around the axes the sizes independently of are.

The differential equations derived from , in which it is expressed that the selectromagnetic Tensions caused flows, for their part, cause electromagnetic forces, which are equilibrium with those caused by out of the exact, read

(1)
$$\begin{cases} 0 = \frac{\partial P}{\partial x} + A\left[\frac{\partial\mathfrak{P}}{\partial t} + \beta\left(\frac{\partial\mathfrak{P}}{\partial y} - \frac{\partial\mathfrak{Q}}{\partial x}\right) - \gamma\left(\frac{\partial\mathfrak{R}}{\partial x} - \frac{\partial\mathfrak{P}}{\partial z}\right)\right] \\ 0 = \frac{\partial P}{\partial y} + A\left[\frac{\partial\mathfrak{Q}}{\partial t} + \gamma\left(\frac{\partial\mathfrak{Q}}{\partial z} - \frac{\partial\mathfrak{R}}{\partial y}\right) - \alpha\left(\frac{\partial\mathfrak{P}}{\partial y} - \frac{\partial\mathfrak{Q}}{\partial x}\right)\right] \\ 0 = \frac{\partial P}{\partial z} + A\left[\frac{\partial\mathfrak{R}}{\partial t} + \alpha\left(\frac{\partial\mathfrak{R}}{\partial x} - \frac{\partial\mathfrak{P}}{\partial z}\right) - \beta\left(\frac{\partial\mathfrak{Q}}{\partial z} - \frac{\partial\mathfrak{R}}{\partial y}\right)\right] \end{cases}$$

Here means the hydrostatic pressure.

Let us put in these equations the above one, so we get

$$0 = \frac{\partial P}{\partial \varrho} + \varrho A^2 a^2 \left(\frac{3\varrho^2}{r^8} - \frac{2}{r^6} - \frac{6zt}{r^8} \frac{1}{\varrho} \frac{\partial \psi}{\partial \varrho} \right),$$

$$0 = \frac{\partial P}{\partial z} + z A^2 a^2 \left(\frac{3\varrho^2}{r^8} - \frac{6t}{r^8} - \frac{\partial \psi}{\partial z} \right).$$

The angular velocity has completely fallen out, so there need not need to have any value of zero.

If we get out of , this is what we are gingened

(2) $$\varrho z - t \frac{\partial \psi}{\partial \varrho} + \frac{8zt}{r^2} \left(z \frac{\partial \psi}{\partial \varrho} - \varrho \frac{\partial \psi}{\partial z} \right) = 0.$$

One looks directly from this equation that the factory must be contained. For is the charge of the electric colon zero. It would therefore become infinite at the moment when the charge begins, the currents in the ether.

Since the Maxwell's differential equations are fully fulfilled, there is no reason to exclude such a charge that increases in zero time.

A solution of differential equation (2) is

$$\psi = \frac{r^2 z}{10t}$$

This follows

$$\zeta = \frac{1}{\varrho} \frac{\partial \psi}{\partial z} = \left(\frac{2z^2 + r^2}{10t} \right) \frac{1}{\varrho},$$

$$-\gamma = \frac{1}{\varrho} \frac{\partial \psi}{\partial \varrho} = \frac{2z}{10t}.$$

[**v**] So the ether would flow parallel to the streamlines,

in which theplanes laid by the*z -axis are the surfaces*$r^2 z = \text{const.}$cut.However, search a flow is hydrodynamically impossible because of the speed$\gamma$for$\varrho = 0$becomes infinite.

As a second case, we consider an electrimost point with the charge , which moves through space with the constant velocity . This case is treated entirely by , namely its solution yields following values of electric and magnetic forces, in relation to a coordinate system fixed in the electris within the electris, in whose -Axe the movement takes place.

$$X = \tfrac{1}{v}\tfrac{\partial U}{\partial x}\left(1 - A^2v^2\right), \qquad Y = \tfrac{1}{v}\tfrac{\partial U}{\partial y}, \qquad Z = \tfrac{1}{v}\tfrac{\partial U}{\partial z},$$

$$M = -A\tfrac{\partial U}{\partial z}, \qquad N = A\tfrac{\partial U}{\partial y}, \qquad L = 0.$$

.

Then it yields for the sizes $\mathfrak{P},\ \mathfrak{Q},\ \mathfrak{R}$

$$\mathfrak{P} = \frac{\mathfrak{A}\varrho^2}{\left(r^2 - A^2v^2\varrho^2\right)^3}, \quad \mathfrak{Q} = -\frac{\mathfrak{A}xy}{\left(r^2 - A^2v^2\varrho^2\right)^3},$$

$$\mathfrak{R} = -\frac{\mathfrak{A}xz}{\left(r^2 - A^2v^2\varrho^2\right)^3},$$

$$\mathfrak{A} = e^2vA\left(1 - A^2v^2\right).$$

Let's resume

$$\alpha = -\frac{1}{\varrho}\frac{\partial\psi}{\partial\varrho}, \quad \beta = \frac{\partial\psi}{\partial x}\frac{y}{\varrho^2} + \eta z, \quad \gamma = \frac{\partial\psi}{\partial x}\frac{z}{\varrho^2} - \eta y, \mathfrak{S} = \frac{\mathfrak{A}}{\left(r^2 - A^2v^2\varrho^2\right)^3}.$$

so we get out of the equations (1)

$$0 = \frac{\partial P}{\partial\varrho} + A\left(-v\frac{\partial\mathfrak{S}}{\partial x}x\varrho - \varrho v\mathfrak{S} + \frac{\partial\psi}{\partial\varrho}\left[3\mathfrak{S} + x\frac{\partial\mathfrak{S}}{\partial x} + \varrho\frac{\partial\mathfrak{S}}{\partial\varrho}\right]\right),$$

$$0 = \frac{\partial P}{\partial x} + A\left(-v\frac{\partial\mathfrak{S}}{\partial x}\varrho^2 + \frac{\partial\psi}{\partial x}\left[3\mathfrak{S} + x\frac{\partial\mathfrak{S}}{\partial z} + \varrho\frac{\partial\mathfrak{S}}{\partial\varrho}\right]\right).$$

[**vi**] Let's call$\mathfrak{U}$the size

$$3\mathfrak{S} + x\frac{\partial\mathfrak{S}}{\partial x} + \varrho\frac{\partial\mathfrak{S}}{\partial\varrho},$$

thus yields the elimination of *P*

(3) $$0 = v\varrho\frac{\partial\mathfrak{U}}{\partial x} + \frac{\partial\psi}{\partial x}\frac{\partial\mathfrak{U}}{\partial\varrho} - \frac{\partial\psi}{\partial\varrho}\frac{\partial\mathfrak{U}}{\partial x}.$$

If the speed in the ether is to stay everywhere, then it must be

$$\frac{\partial\psi}{\partial x} = 0$$

then we have

$$v\varrho = \frac{\partial\psi}{\partial\varrho}, \quad v = -\alpha.$$

The aether therefore flows in relation to the coordinate system moved with the direction at the same speed with the charge at the same speed in the opposite direction, so it rests in relation to a resting coordinate system. This is remarkable because it shows that the movement of electrical quanta is not a reason for a movement of the ether, as assumes.

Movements can occur against this when the aether has one different inertia from zero. I give the calculations for this case, because it gives you an idea of the magnitude of the density, the given cases would have to be enclosed to the ether. Then the components of the accelerations are still to the members of the equations (1)

$$s\frac{d\alpha}{dt}, \quad s\frac{d\beta}{dt}, \quad s\frac{d\gamma}{dt}$$

add where denotes the tightness of the aether and

$$\tfrac{d\alpha}{dt} = \tfrac{\partial\alpha}{\partial t} + \alpha\tfrac{d\alpha}{dx} + \beta\tfrac{\partial\alpha}{\partial y} + \gamma\tfrac{\partial\alpha}{\partial z},$$

$$\tfrac{d\beta}{dt} = \tfrac{\partial\beta}{\partial t} + \alpha\tfrac{d\beta}{dx} + \beta\tfrac{\partial\beta}{\partial y} + \gamma\tfrac{\partial\beta}{\partial z},$$

$$\tfrac{d\gamma}{dt} = \tfrac{\partial\gamma}{\partial t} + \alpha\tfrac{d\gamma}{dx} + \beta\tfrac{\partial\gamma}{\partial y} + \gamma\tfrac{\partial\gamma}{\partial z}$$

In the trap just viewed, the system is stationary in relation to the moving coordinate system. So it's

$$\frac{\partial\alpha}{\partial t} = \frac{\partial\beta}{\partial t} = \frac{\partial\gamma}{\partial t} = 0.$$

Let us put the value of α, β, γone, thus yielding the elimination of

$$\frac{1}{A}\frac{\partial\psi}{\partial x}\frac{\partial}{\partial\varrho}\left[\frac{1}{\varrho^2}\left(\frac{\partial^2\psi}{\partial\varrho^2} - \frac{1}{\varrho}\frac{\partial\psi}{\partial\varrho} + \frac{\partial^2\psi}{\partial x^2}\right)\right]$$

$$-\frac{1}{A}\frac{\partial\psi}{\partial\varrho}\frac{\partial}{\partial x}\left[\frac{1}{\varrho^2}\left(\frac{\partial^2\psi}{\partial\varrho^2} - \frac{1}{\varrho}\frac{\partial\psi}{\partial\varrho} + \frac{\partial^2\psi}{\partial x^2}\right)\right]$$

$$+\frac{v\varrho}{s}\frac{\partial\mathfrak{U}}{\partial x} + \left(\frac{\partial\psi}{\partial x}\frac{\partial\mathfrak{U}}{\partial\varrho} - \frac{\partial\psi}{\partial\varrho}\frac{\partial\mathfrak{U}}{\partial x}\right)\frac{1}{s} = 0.$$

This equation is fulfilled when

$$\frac{1}{\varrho}\frac{\partial\psi}{\partial\varrho} = \quad v + \frac{1}{\varrho}\frac{\partial\psi_1}{\partial\varrho},$$

$$\frac{1}{\varrho}\frac{\partial\psi}{\partial x} = \qquad \frac{1}{\varrho}\frac{\partial\psi_1}{\partial x},$$

$$\frac{1}{\varrho^2}\left(\frac{\partial^2\psi_1}{\partial\varrho^2} - \frac{1}{\varrho}\frac{\partial\psi_1}{\partial\varrho} + \frac{\partial^2\psi_1}{\partial x^2}\right) = -\frac{\mathfrak{U}A}{s}$$

is. It is

$$\mathfrak{U} = -\frac{3A}{\left(x^2 + \varrho^2\left(1 - A^2v^2\right)\right)^3}.$$

To integrate the differential equation, we set

$$\psi_1 = \varrho\varphi.$$

Then it will

$$\frac{\partial^2\varphi}{\partial\varrho^2} + \frac{1}{\varrho}\frac{\partial\varphi}{\partial\varrho} - \frac{1}{\varrho^2}\varphi + \frac{\partial^2\varphi}{\partial x^2} = -\frac{\varrho\mathfrak{U}A}{s}$$

We first consider the differential equation

$$\frac{\partial^2\varphi_1}{\partial\varrho^2} + \frac{1}{\varrho}\frac{\partial\varphi_1}{\partial\varrho} + \frac{1}{\varrho^2}\frac{\partial^2\varphi_1}{\partial\vartheta^2} + \frac{\partial^2\varphi_1}{\partial x^2} = -\frac{\varrho\mathfrak{U}A}{s}\sin\vartheta.$$

Their integral is

$$\varphi_1 = \frac{A}{4\pi s}\int\int\int \frac{d\varrho'\ d\vartheta'\ dx'\ \varrho'^2\,\mathfrak{U}'\sin\vartheta'}{\sqrt{(x-x')^2 + \varrho^2 + \varrho'^2 - 2\varrho\varrho'\cos(\vartheta-\vartheta')}},$$

,

$$S = \frac{A}{4\pi s}\int\int \varrho'^2 d\varrho'\,dx'\mathfrak{U}'R,$$

$$R = \frac{2}{\sqrt{\varrho'\varrho}}\left(\left(\frac{2}{x} - \varkappa\right)K - \frac{2}{\varkappa}E\right),$$

$$\varkappa^2 = \frac{4\varrho'\varrho}{(z'-z)^2 + (\varrho+\varrho')^2}, \quad K = \int_0^{\frac{\pi}{2}} \frac{d\varphi}{\sqrt{1-\varkappa^2\sin^2\varphi}}, \quad E = \int_0^{\frac{\pi}{2}} \frac{d\varphi}{\sqrt{1-\varkappa^2\sin^3\varphi}}.$$

Then the differential equation is enough

$$\frac{\partial^2 S}{\partial \varrho^2} + \frac{1}{\varrho}\frac{\partial S}{\partial \varrho} - \frac{1}{\varrho^2} S + \frac{\partial^2 S}{\partial x^2} = -\frac{\varrho \mathfrak{A} A}{s}$$

and it's there .

These are the same expressions that result in the velocity rings in a liquid at circular vortex rings, where then the -Axe is the ax of the vortex rings, when the rotation speed of the liquid heals around the circular rotation axe

$$\frac{3\mathfrak{A}\varrho A}{2s\left[x^2 + \varrho^2\left(1 - A^2 v^2\right)\right]^3}$$ is.

The order of magnitude of the occurring motion thus depends primarily on the size

$$\frac{3ve^2 A^2 (1 - A^2 v^2)\varrho}{2s\left[x^2 + \varrho^2\left(1 - A^2 v^2\right)\right]^3}$$

away. With constant and it has a maximum for

$$v = \frac{1}{\sqrt{3}A}$$

and is the same

$$\frac{e^2 A}{\sqrt{3}s}.$$

We have electrical charges flying through the room at an almost size speed of nearly such a large thing.

Let's assume it would be there select units transported in the second and take a third of the speed of light for the speed, so in a tube of 50 cm in length would be resistant to a charge of in motion. The size of the rotation speed would then be for and approximately

$$\frac{1}{2} 10^{-13} \frac{1}{s}.$$

Outside the tube, noticeable movements would only occur at exceptionally low density of the ether. The processes in the immediate vicinity of the charge cannot be said anything in particular.

Reflection on moving transparent media.

An example where the tensions in the ether motion would cause the reflection of electromagnetic level waves at the boundary of moving insulators offers. Let's mark the angle of incidence , with the index the incoming, with r the reflect size components, is according to

the known laws

$$Y_e = \sin\left(\frac{x\ \sin\varphi + z_1\cos\varphi}{\lambda} - \frac{t}{T}\right)2\pi,$$

$$L_e = \cos\varphi\sin\left(\frac{x\ \sin\varphi + z_1\cos\varphi}{\lambda} - \frac{t}{T}\right)2\pi,$$

$$N_e = -\sin\varphi\sin\left(\frac{x\ \sin\varphi + z_1\cos\varphi}{\lambda} - \frac{t}{T}\right)2\pi.$$

If we move the plate with the speed in the direction , so we have to put for the reflected waves to

$$Y_r = R\ \sin\left(\frac{x\ \sin\varphi - z_1\cos\varphi}{\lambda} + \frac{A^2 v z_1}{T} - \frac{t}{T}\right)2\pi,$$

$$L_r = -R\ \sin\left(\frac{x\ \sin\varphi - z_1\cos\varphi}{\lambda} + \frac{A^2 v z_1}{T} - \frac{t}{T}\right)2\pi,$$

$$N_r = -R\ \sin\left(\frac{x\ \sin\varphi - z_1\cos\varphi}{\lambda} + \frac{A^2 v z_1}{T} - \frac{t}{T}\right)2\pi$$

based on a coordinate system moved with the plate. If we reach everything on a fixed coordinate system, so we have to put. The Factor is not exactly the same as with a resting system. The electromagnetic pressure does work and reduces or increases the energy of the radiation. However, the limiting conditions can only be fulfilled if one assumes that this change in energy spreads reflect and broken rays so switched as if the incoming wave already leads with it the energy multiplied or reduced in the relationship of this work.

$$\mathfrak{T} = \frac{\partial\mathfrak{R}}{\partial x} - \frac{\partial\mathfrak{P}}{\partial z} = \frac{2\sin 2\varphi}{\lambda}R\left\{\frac{1}{\lambda}\sin\left(\frac{2z\ \cos\varphi}{\lambda} - \frac{2vt\ \cos\varphi}{\lambda}\right)2\pi\right\},$$

Let's put

$$0 = \frac{\partial\alpha}{\partial x} + \frac{\partial\gamma}{\partial z},$$

so

$$\alpha = \frac{\partial\psi}{\partial z} \quad \gamma = -\frac{\partial\psi}{\partial x},$$

thus the equations

$$0 = \frac{\partial \mathfrak{T}}{\partial t} + \frac{\partial \psi}{\partial z}\frac{\partial \mathfrak{T}}{\partial x} - \frac{\partial \psi}{\partial x}\frac{\partial \mathfrak{T}}{\partial z},$$

so

$$\frac{\partial \psi}{\partial x} = -v \quad \gamma = v.$$

The tension in the aether would therefore only stop if it moved at the same speed as the moving plate. However, this only applies to small speeds. For larger ones would result in quite complicated values dependent on the vibrational period.

The fact that the movement of the aether lift up the tensions in the ether only in the first approach is due to the fact that the movement still caused by the movement is still caused by the ray, the ethers, which are known to be moved by the assumption, cannot easily be explained.

It does not seem hopeless to experiment in the direction of whether the aether is carried in the direction of the movement during reflection on fast-moving plates.

The assumption of dormant aethers.

After the foregoing, we cannot completely deny the possibility that the ether is moving. But the difficulties of carrying out such an assumption should already come down in the sketches. As soon as it is possible to do justice to all the facts observed so far, if one considers the ether to be dormant, this path will initially recommend itself through its simplicity. However, we then violate a very general mechanical principle from the outset, that the equality of effect and counteraction,if we do not want to assume that the electromagnetic voltages that want to set the ether in motion are lifted by a certain rigid structure. And in general, when we deny it mobility, the aether becomes a substrate of highly indeterminate properties, which we actually only use to make the finite value of the speed of light more understandable.

But to anyone who initially only feels the most general representation of facts will be particularly recommended this way.

The acceptance of a resting aether was actually those represented by , although there is still talk of a thematic continuation of the aether. However, this continuation only takes place inside the weighing body as soon as it itself is moved and can be completely replaced by the view that what is continued is not the aether itself, but the part of the electromagnetic energy that adheres to ponderable bodies. This comes very clearly in the calculation of [2] , which shows that the Coefficient is presented by the continuation of a beam of light in the moving medium, when the aether itself rests, the electromagnetic energy is thematically present in the aether, then in the ponderable substance.

A detailed execution of the theory based on the assumption of dormant aethers and unchangingly charged ions as well as complete discussion of all essential observation results is present in the work of HA [3] included. From a very similar point of view, E. [4] .

F r o m his assumption, immediately the coefficients of continuation of light through moving media, the aberration and the principle. All three are immediately connected and result from a

general sentence, according to which all equations of small vibrations apply to resting bodies can be transferred to moved if instead of time the variable introduces where the time means that the light uses to get from a fixed point to an arbitrary considered in free Aether, and is the ratio of the body's speed to the speed of light.

For the continuation coefficients, another corection member is eager for itself, which is caused by the fact that the movement also occurs a change in the oscillation duration after the principle. It also follows immediately, that the influence of the earth's movement is shown in the aberration and that the pismatic deflection and the observation of the wavelength is not influenced by lattices. It also follows that a stationary current on another wire by means of the earth's motion does not exert an induction effect, because the movement creates a rostatic charge, which compensates the effect.

In the case of induction effect, the influence of earth moving occurs only in the ratio of size so there is no chance of experimental confirmation.

Since the assumption of immobile aethers proves to be perfectly sufficient by Lorentz's theory, which has been worked through the extensively worked theory, in order to point out a number of man-cold and previously little explained phenomena of the influence of motion on the electromagnetic processes , we must now point to a difficulty of principal nature, which arises when this theory is carried out.

This difficulty is closely related to the fact that changing electromagnetic states cause forces that would set the ether in motion if it were movable. Let us think of a body in the free aether, for example, in the form of a thin plate, which has different radiance for heat rays on both sides. Since , according to Maxwell's theory, the rays sent out exert pressure on the surface, this pressure would prevail on the side of the greater radiance and set the body in motion .We would therefore have the case that a body sets its center of gravity in motion through its own inner energy. If we therefore accept the ether as immobile, there would be a violation of the general sentence from the center of gravity. On the other hand, the assumption of movable ethers, which possesses inertia, would escape this objection.

However, the set of focence may be a speci's nature and limit itself to certain groups of effects in which no moving forces occur in the aether, as is actually the case with the usually observed ponderomotor effects.

Under all circumstances, this point is particularly important for further theoretical training.

The test results.

After we have discussed the two theoretical constellations to be separated, we want to take a look at the attempts that have been made so far.

The main experiments related to our question are the following:

A. Experiments with positive results.

1. The aberration of the light of the fixed stars. The aberration found a simple explanation based on the emission hypothesis of light. The difficulties in the undulation theory are only

quite recently eliminated by HA by assuming aethers.

2. This is by its nature of general kinematic significance, but must nevertheless be taken into account in the question of moving or resting ethers.

3. The attempt of and its repetition by and . A beam of light that goes through flowing water in the direction of the movements experiences an acceleration of the gear in relation where speed, indicate the refractive index of water. This result finds its full explanation in the assumption of dormant Aethers.

B. Experiments with negative results.

1. attempt to see whether the movement of the earth influences the refraction of the light coming from the fixed stars.

2. The interference test 's. Through two tubes filled with water inclined against each other, the two rays of an interferential refractor are sent in such a way that one beam passes the one tube after the first reflection (on the one glass plate), the other stream the second tube after the second reflection (on the other glass plate), ie Although both tubes are taken by the earth's movement, there is no change in the interference strips, although one beam accelerates, the other is delayed,

Both results follow immediately from the assumption of resting aethers.

3. The attempt by whether the absorption line of the sodium vapor is affected by the movement of the Earth.

The positive result of would be incompatible with the theory of resting aethers. However, the shift found is so small that observation errors are not excluded.

4. Des attempt to the induction effect of two wire rollers to a third by the fact that the direction of induction each roll once in the direction of the earth's movement, then falls into the perpendicular one.

HA has said that this influence depends only on the square of the condition of the earth's ratio to the speed of light, ie it is not observable, because the earth motion creates an electrical charge on the conductors, which can create the effect of the first order.

5. Lodge's attempts to investigate the extent to which the surrounding aether is taken by the movement of heavy or non-magnetic masses.

6. Zehnder's experiments on whether the aether is moved by the movement of a piston in an air-thinned room.

The experiments of both observers were made with sensitive interference methods and yielded negative result, thus easily matching the assumption of resting aethers.

7. Mascart's experiments on the rotation of the polarization plane in the quartz. There was no change in the rotation once the light rays had the direction of the earth's motion, then the opposite.

HA has given the theory of this phenomenon and finds that assuming resting aethers the earth's motion once changes the existing rotation and adds a second independently.

The negative result of the observations would show that in the quartz these two rotations caused by the influence of the earth's motion are abolished.

8. The attempt of whether the motion of the Earth is generated by a charged condenser magnetic forces.

The negative result of this attempt is not compatible with the assumption of dormant ethers.

Also electric charges and magnets would have to produce magnetic, electric forces by the movement of the earth. The absence of these forces would also not be compatible with the presupposition of resting aethers.

9. experiment on the influence of earth motion on the rotation of the polarization plane by glass columns. The positive result of this attempt has recently been questioned. It would be with the assumption of dormant aethers after the investigations of HA will not be compatible.

10. The attempt by and . When the aether rests, the time a beam of light needs to go back and forth between two glass plates must change when the plates move. The change depends on the size however, it would have to be observable when applying interference.

[]The negative result is incompatible with the assumption of resting aethers. This assumption can only be kept by the hypothesis that the length dimensions of solid bodies are changed by the movement through the resting ether in the same proportion to compress the extension of the path of the light beam.

The assumption of movable aethers would provide the possibility that the aether is taken away by the movement of the earth and rests relative to it. This would explain all negative test results. But then the explanation of aberration would be left.

Gravity and inertia.

The fact that gravity takes an exceptional position and has no noticeable relationships to the other natural phenomena has been often pointed out. Their rejection of compressive forces is complicated by the fact that the energy precursor of a gravitating system has its greatest value at the infinite distance of the individual mass theories. However, it is not always clearly pointed out enough that the acceleration of heavy masses is highly likely attached to gravity, because two independent definitions of the mass are obtained through acceleration and by gravity, which, as far as the observations here are very precise , coincidence. If one demands further explanation of gravity, it would also have to give account of it why it is necessary to accelerate heavy masses. That the two definitions of the masses agree would then have to come out as a consequence of this explanation. Whether such a theory has to rely on the ether cannot be asserted with certainty, but it is likely.

However, it must also be emphasized here that it is by no means clear whether a return of all effects on tensions in the ether can succeed, just as it remains doubtful whether the events in the ether can be presented completely satisfactorily by the laws of mechanics .

[]If we now summarize the results, the impression is that there are still a number of questions to be dealt before we can decide on the path to be entered by science.

The assumption of moving aethers without inertia, as we have seen, leads to little probable consequences.

As an experiment that would be important for this assumption, it is recommended to attempt whether the aether is set in motion by the movement of reflective transparent media.

However, since the aether is not set in motion by the movement of solid body as far as known, a negative result is likely.

The following difficulties are facing the acceptance of quite resting Aethers:

1. Violation of the sentence from the center of gravity (eg the equality of effect and counteraction).

2. The negative results of the experiments of and , of and possibly the experiments of and .

It would therefore be strongly desirable to repeat or re-establish the following experiments.

1. Actions Earth's motion to rotation of the polarization plane

    a) naturally rotating substances,

    b) by glass columns.

2. Does the earth's motion through the movement of electric charges evoke the magnetic forces demanded by the theory and the corresponding electrical forces through the motion of magnets?

When the results of these experiments are fully clarified, it will become clear whether the otherwise simple theory rests or must be retained. Should it have to be abandoned, it would, as it seems to me, only the way out indicated by would be left; namely, influence of gravity on the light ether. This assumption seems to me to be equivalent to the prerequisite of a small sluggish mass of the light ether.

[]It would then be explained that as a result of its significant gravity, the Earth is pulling the aether, while the movement of small solid bodies on Earth has no influence. The negative result of the attempts mentioned would be explained without further ado.

Then, however, the difficulties in the explanation of the aberration, on which HA has made it aware. However, whether the same ones are not to be overcome if the influx of the ether is taken into account under the influence of gravity needs a special investigation. For the purpose, the hydrodynamic problem would have to be solved, to determine the movements of a liquid through which a point moves at a constant velocity that attracts the individual liquid theile according to Newton's laws.

The Maxwell's stresses that would set the aether in motion are always because they appear to be multiplied by the reciprocated light speed, so small that the movements become generally imperceptible even at very low lower mass.

The task of the theory would then be to visit such examples where the movement of the aether could be actually observed.

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1. have made the attempt with Jamin's interferential refractor to attempt whether a ray of light passing through a vacuum tube is accelerated by the cathode beams; but the result was quite negative.
2. R e i f f , Wied. Ann. 50. p. 367. 1893
3. L o r e n t z
4. W i e c h e r t
