The optical systems variations in motion and the Earth's translation

OPTICS - The optical systems variations in motion and the Earth's translation. Note by Mr. G. Sagnac, presented by Mr. Lippmann.

1. "The effect of elementary movement. Elementary movement. - I have explained kinematically the entrainment of the waves by the water in movement (Comptes rendus, Vol. 129, p. 888; French Society of Physics, 1899); the principle of Veltman and the astronomical aberration studied with an optical system (Comptes rendus, Vol. 141, 1905, p. 1220). My reasoning assumes that the ether in the void is not at all dragged in the translation of matter (Fresnel's hypothesis) or at least that the speed of the system in translation relative to the ether of the void is uniform and diverges at various points of the system. But whatever the distribution of the vector v in the ether surrounding the system, the principle of the effect of elementary movement that I established in 1899 (loc. cit.) and which will serve as a base for a more systematic theory for a general kinematic theory.

On each elemental length of the system tied to an optical system, the translation effect of the system makes the duration of propagation of the light waves vary due to the translation effect of the system; the effect of elementary movement represents a significant component. I designate the component...

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...following the speed v of the system's element relative to the ether; V0V0 represents the speed of light in the void, even if the element is contained within one of the optical system's material mediums.

2. Optical Vortex Effect - I refer to the variation ΔTΔT that the duration of propagation around the circuit perimeter undergoes under the influence of the relative movement of this circuit and the ether of the void. It's the sum of the elementary extensions applied to all the elements of the circuit. The sum of the values of udl/V0udl/V0 represents (according to Lord Kelvin) the circulation of the ether along the circuit or (Bjerknes) the intensity of the corresponding vortex through the circuit. Let's introduce the average value bhbh of the Bjerknes vector, representing the intensity or density of the vortex perpendicular to the surface S of the circuit, assumed to be flat. The optical vortex effect has a value...

ΔT=bhSV02ΔT=V02bhS

$$\Delta T = \frac{b_h S}{V_0^2}$$

If the intensity of the vortex is always zero, in other words, if the relative movement of the ether is irrotational, the value of ΔT is null, and we can apply the Veltman theorem (loc. cit.). If, on the contrary, the relative movement of the ether is rotational, the delay ΔT produces a phase variation (wavelength):

Let's then interfere with two systems of light waves that have traveled in opposite directions in the optical circuit of large surface area S (see my Notes in Comptes rendus, Vol. 150, 1910, pp. 1902 and 1676). The optical vortex effect will alter the phase difference of the two waves by 2x, and because it results from first-order movement effects that change direction with the propagation of light.

3. Upper limit of the Ether's Entrainment in Earth's Translation - If the ether is assumed to be entrained near the ground, the relative speed v of the Earth and the ether increases by Δv when the altitude increases by Δz, and the speed becomes equal to the Earth's translation speed at the altitude where the entrainment ceases...

[This section continues with the discussion on the optical angular vortex effect, precision of observations, and the implications of the results.]

THERMODYNAMICS - Application of Lenz's principle to the phenomena accompanying the charging of capacitors. Note by Mr. A. LEDU, presented by Mr. E. Bouty.

I will first summarize the demonstrations related to these phenomena given by Pellat and by Sacerdote, using the remark by Massieu.

Consider a closed capacitor whose thin armatures are glued to the dielectric. The external armature B communicates with the outer environment, while the internal is charged to a potential V>0V>0. The state of this capacitor depends on V, its temperature T, and the uniform pressures PP and pp prevailing on the outside and inside, respectively. Assume T is constant. Under the influence of variations dVdV, dTdT, dpdp, the charge MM of MM increases by dMdM; the dielectric receives a quantity of heat dQdQ; the internal volume (cavity) r increases by dv, and the external volume v′ by dF′. The increase in energy of the capacitor in this transformation is:

dU=VdM+JdQ+pdv−Pdv′dU=VdM+JdQ+pdv−Pdv′

$$dU = VdM + JdQ + pdv - Pdv'$$

If this transformation occurs reversibly, dU, d(MV), d(pv), and d(Pv′) are exact differentials, and so is:

$dX=dU-d(MV)-d(pv)+d(Pv')=-MdV+JdQ-vdp$$dX=dU-d(MV)-d(pv)+d(Pv')=-MdV+JdQ-vdp$

$$dX = dU - d(MV) - d(pv) + d(Pv') = -MdV + JdQ - vdp$$

Let's define:

$dQ=adV+bdp+cdT$$dQ=adV+bdp+cdT$

$$dQ = adV + bdp + cdT$$