OPTICS – *On the theory of the partial entrainment of ether.*
Note ([1]) By M. **H. MINEUR,** presented by M. Deslandres.

I. We propose, in this Note, to show which kinematic conditions must be satisfied with the theory of entrainment of the ether by the ground to give an account of the known facts. Let us consider two spheres S, S' of center O of respective rays R and R', be animated by a common translational speed of V parallel to O*x*. Let ρ be the density and $\vec{u}(u,v,w)$ the speed of ether at a point M. Let $\vec{\xi}(\xi,\eta,\zeta)$ be the curl and Θ the divergence of $\vec{u}$, where the speed *c* of the light is defined by the relation $c\sqrt{f(\rho)}=c_0$.

We impose on $\vec{u}$ the following conditions: $|u-\mathrm{V}|, |v|$ and $|w|$ on S and $|u|, |v|$, $|w|$ on S' are lower than $\varepsilon\mathrm{V}$.

II. Let α,β,γ be the direction cosines of a luminous ray outside S', A', B', C' these same corrected quantities of the aberration and A, B, C cosines of this ray when it arrives on S; one has

$$\mathrm{A'}-\mathrm{A}=\int\left(\beta\zeta-\gamma\eta+\frac{c_0}{2f(\rho)}\left[\left\{\beta\frac{\partial f(\rho)}{\partial x}-\alpha\frac{\partial f}{\partial y}\right\}\beta+\left\{\gamma\frac{\partial f}{\partial x}-\alpha\frac{\partial f}{\partial z}\right\}\gamma\right]\right)dt,$$

the integral being extended to the course of the luminous ray.

III. A rather simple analysis leads to the following expression of $\vec{u}$:

$$\vec{u}=\vec{u}^{?}+\mathrm{grad}\varphi+\vec{a},$$

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where φ is a harmonic function and $\vec{u}^{?}$ a vector, whose components normal to OM are null on S and S', the component θ of $\frac{\vec{u}^{?}}{r}$ according to OM satisfies the equation

$$\Delta\theta = \frac{1}{2}\frac{\partial\left(r^2\Theta\right)}{\partial r} \qquad (r = \mathrm{OM}),$$

moreover $r\frac{\partial\theta}{\partial r} + \theta$ is known on S and S'. $\vec{a}$ is a vector smaller than $\varepsilon \mathrm{V}$.

IV. Let us suppose c is a function of ρ and $f(\rho) = \rho$. The law of the aberration cannot be checked.

V. Let us suppose with Lorentz that c is independent of ρ, and that ρ depends only on r. So that the law of the aberration is checked, it is necessary and it is enough that $\vec{\xi} = 0$. One can establish that the density of ether decreases from S to S'. There exists at least a ray OMM' resulting from O such as

$$\left|\int_{\mathrm{R}}^{\mathrm{R'}} \Theta dr\right| > 2\mathrm{V}(1 - 2\varepsilon),$$

the integral being taken along MM'. One concludes from it that the report of the density of ether on S to its density on S' is higher than $7(1 - 4\varepsilon)$.

VI. Let us imagine that S is the terrestrial surface and S' a sphere of a large ray; we can admit that the conditions of no. I are checked for $\varepsilon = \frac{1}{20}$. If one wants to explain the experiment of Michelson by the assumption of a partial entraining of ether by these grounds, one is led to admit that your density of this medium varies at least in the ratio from 5 to 1 when one passes from terrestrial surface to the area where the ether is not involved. Such a consequence makes this assumption rather improbable.