PAPERS COMMUNICATED

51. *On the Geometry in Microscopic and Macroscopic Space.*

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In the present paper I intend to construct a new geometry which will have its foundation on the proper qualities of geometry, and which, based on the common and actual physical demonstrations and observations, will express pure-mathematically the relations between the physical realities. Consequently, I have decided to give up the conventional and ordinary method of deriving the microscopic space from the macroscopic, and, reversing the process, to explain the macroscopic from the microscopic, the metrical conception of the latter being defined by the physical phenomena. I will now develop the theory of *kinematic connections*,[1] which seems to me quite natural to establish a unified field theory.

Consider the set of matrices E_λ $(\lambda=1, 2, 3, 4, 5)$:

$$E_1=\begin{pmatrix}0&0&1&0\\0&0&0&1\\1&0&0&0\\0&1&0&0\end{pmatrix}\qquad E_2=\begin{pmatrix}0&0&0&-i\\0&0&-i&0\\0&i&0&0\\i&0&0&0\end{pmatrix}\qquad E_3=\begin{pmatrix}0&0&0&1\\0&0&-1&0\\0&-1&0&0\\1&0&0&0\end{pmatrix}$$

$$E_4=\begin{pmatrix}0&0&-i&0\\0&0&0&i\\i&0&0&0\\0&-i&0&0\end{pmatrix}\qquad E_5=\begin{pmatrix}1&0&0&0\\0&1&0&0\\0&0&-1&0\\0&0&0&-1\end{pmatrix}.$$

Then we get

$$(1)\qquad \tfrac{1}{2}(E_\lambda E_\mu+E_\mu E_\lambda)=\delta^\mu_\lambda\,,$$

where the δ^μ_λ denotes *Kronecker*'s delta. Let us now consider the five independent real variables x^1, x^2, x^3, x^4, x^5 of which at least one is not zero. Also suppose that we have twenty-five real functions $p_\mu^{\cdot\lambda}$ of the variables, and, let $q^\lambda_{\cdot\mu}$ be defined by equations

$$(2)\qquad p_\nu^{\cdot\lambda}q^\mu_{\cdot\lambda}=\delta^\mu_\nu\,.$$

We now define the matrices a_λ and a^μ, by the following equations:

$$(3)\qquad a_\lambda=p_\lambda^{\cdot\mu}E_\mu\,,\qquad a^\mu=q^\mu_{\cdot\lambda}E^\lambda\qquad(\lambda, \mu=1, 2, 3, 4, 5)\,,$$

where $E^\lambda=E_\lambda$. From (1), we have

$$(4)\qquad a_{(\lambda}a_{\mu)}=\sum_{\omega=1}^{5}p_\lambda^{\cdot\omega}p_\mu^{\cdot\omega}\,,$$

and

1) T. Hosokawa: Kinematic Connections and their Application to Physics, Proc. **10** (1934), 49-52.