The Special Theory of Electromagnetism

THE law of addition of collinear velocities as derived from the Lorentz transformation in special relativity is :

$$W = \frac{U + V}{1 + UV/c^2} \qquad (1)$$

U and V being the components, W the resultant velocity and c the velocity of light. It follows that W can never be greater than c.

Despite this failure in kinematics of the classical law of vector addition, that law is still used in other fields of physics. This communication shows what modifications to electrostatic theory are necessary if a rule analogous to equation (1) is adopted in its place.

Introducing 'electric interval' $d\sigma$ by the relation :

$$d\sigma^2 = dr^2 - \varkappa^{-2} d\varphi^2 \qquad (2)$$

where dr and $d\varphi$ have their usual meaning for an observer and $\varkappa$ is a universal constant, the addition of collinear electric vectors now follows the rule :

$$E = \frac{E_1 + E_2}{1 + E_1 E_2/\varkappa^2} \qquad (3)$$

and $\varkappa$ is recognized as the limiting attainable resultant, presumably corresponding to a break-down field-strength.

Discrepancies from classical theory will be imperceptible in weak fields, so that support for the new hypothesis must be sought under conditions near breakdown.

Considering the inverse square law, a geometrical concept in which the possible effect of the field on measurement of distance is ignored, it appears that distance must be replaced by interval in its formulation, so that the field of an electron is represented by :

$$\frac{d\varphi}{d\sigma} = -\frac{e}{\sigma^2} \tag{4}$$

e being the charge. The measured field-strength is then :

$$\frac{d\varphi}{dr} = -e(\sigma^2 + e^2/\varkappa^2)^{-1/2} \tag{5}$$

which compares with the Born and Infeld formula.

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