Note on "Mass-Energy Relationship"*

HERBERT E. IVES
32 Laurel Place, Upper Montclair, New Jersey
(Received November 27, 1952)

IN stating that the expression

$$(H_0-E_0)-(H_1-E_1)=\frac{L}{(m-m')c^2}(K_0-K_1) \tag{1}$$

"may be considered" as the difference of the two relations,

$$(H_0-E_0)=\frac{L}{(m-m')c^2}(K_0+C) \tag{2a}$$

$$(H_1-E_1)=\frac{L}{(m-m')c^2}(K_1+C), \tag{2b}$$

my meaning was that *algebraically*, it might be thus broken down, with no commitment that this breakdown met with approval or had any physical significance. The procedure was picked because the breakdown of the left-hand side of Eq. (1) into this particular pair of differences was the one chosen by Einstein. Its purpose was to show most directly that had he used only the data supplied for the solution of the problem (namely, Table I), he would not have obtained the values of H_0-E_0 and H_1-E_1 he introduced. No implication that this kind of algebraic breakdown was sound was intended, and the propriety of the expressions (2a) and (2b) does not figure in the argument.

Riseman and Young's argument from dimensional considerations, although applied to the "phantom" equation (2a) is worthy of serious consideration when applied to the algebraically unbroken-down Eq. (1). In this, since all the (upper) brackets are of the dimensions of energy, the term $L/(m-m')c^2$ must be dimensionless, i.e., a constant. This much *can* be learned from the two-observer procedure. As to the value of the constant, nothing can be learned from the data provided. If we put $L/(m-m')c^2$ $=$const. and introduce in Eq. (1) the table values of the H's and E's, we merely travel in a circle, arriving back at $C=L/(m-m')c^2$. To derive the exact mass-energy relation, something must be added to the information supplied. This added factor must be supplied from valid physical considerations, not by assumption.

* See preceding letter by J. Riseman and I. G. Young, J. Opt. Soc. Am. 41, 618 (1953).