ABOUT ENERGY

Florian Ion TIBERIU-PETRESCU[*]

The paper presents, shortly, some relations which may deduce the total energy of a corpuscle, W, the kinematical energy of this particle, E, and the energy ΔE that increases the corpuscle mass, from the rest mass, m_0, to mass m. Generally, one considers the ΔW energy like the exactly kinematical energy and E energy like an approximately kinematical energy. In this paper one presents an original method to deduce the kinematical energy E, starting from kinematical Force (Lagrange Force). The author wants (in this mode) establish the E energy of a corpuscle like the exactly kinematical energy. If E is the really kinematical energy of a corpuscle, what's the ΔW energy? ΔW represents a sum between two energy: E (the kinematical energy) and ΔE (the energy which increases the mass of a corpuscle from the rest mass, m_0, to m mass, when the particle speeds from v=0 to v).

Keywords: Particle, corpuscle, electron, mass, rest mass, Lagrange force, quantum, energy, total energy-W, kinematical energy-E, increase mass energy-ΔE, a sum energy-ΔW=E+ΔE.

Introduction

The paper presents, shortly, some relations which may deduce the total energy of a corpuscle, W, the kinematical energy of this particle, E, and the energy ΔE that increases the corpuscle mass, from the rest mass, m_0, to mass m. Generally, one considers the ΔW energy like the exactly kinematical energy and E energy like an approximately kinematical energy. In this paper one presents an original method to deduce the kinematical energy E, starting from kinematical

[*] Prof. Assist., Department of TMR, University POLITEHNICA of Bucharest, ROMANIA

Force (Lagrange Force). The author wants (in this mode) establish the E energy of a corpuscle like the exactly kinematical energy. If E is the really kinematical energy of a corpuscle, what's the ΔW energy? ΔW represents a sum between two energy: E (the kinematical energy) and ΔE (the energy which increases the mass of a corpuscle from the rest mass, m_0, to m mass, when the particle speeds from v=0 to v).

The new relations

One writes the Newton Force (1):

$$F = m \cdot a = m \cdot \frac{dv}{dt} \qquad (1)$$

where m=corpuscle mass, v=corpuscle velocity.
The complete force can be written:

$$F = \frac{dk}{dt} = \frac{d(m \cdot v)}{dt} = m \cdot \frac{dv}{dt} + v \cdot \frac{dm}{dt} = m \cdot a + v \cdot \frac{dm}{dt} \qquad (2)$$

where k is the corpuscle impulse.

The total elemental energy of a corpuscle can be written:

$$dW = F \cdot ds = m \cdot \frac{dv}{dt} \cdot ds + v \cdot \frac{dm}{dt} \cdot ds = m \cdot dv \cdot \frac{ds}{dt} + v \cdot dm \cdot \frac{ds}{dt} = \\ m \cdot dv \cdot v + v \cdot dm \cdot v = m \cdot v \cdot dv + v^2 \cdot dm = \frac{1}{2} \cdot m \cdot d(v^2) + v^2 \cdot dm \qquad (4)$$

when the force F take the form (2):

One writes now the Lorentz relation (5):

$$m = \frac{m_0}{\sqrt{1 - \frac{v^2}{c^2}}} = \frac{m_0 \cdot c}{\sqrt{c^2 - v^2}} \qquad (5)$$

One differentiates the Lorentz expression (5) and one obtains the relation (6):

$$\frac{1}{2} \cdot m \cdot d(v^2) = (c^2 - v^2) \cdot dm \qquad (6)$$

With the relation (6) the expression (4) takes the form (7):

$$dW = \frac{1}{2} \cdot m \cdot d(v^2) + v^2 \cdot dm = (c^2 - v^2) \cdot dm + v^2 \cdot dm = c^2 \cdot dm \qquad (7)$$

One integrates the expression (7) and one obtains the form (8), for the total energy W (when m=0, W=0, and ⇒ the integration constant=0).

$$W = m \cdot c^2 \qquad \text{(Einstein relation)} \qquad (8)$$

W=the total energy of a corpuscle, obtained without relativity theory (8). With the Lorentz expression (5) the relation (8) takes the forms (9):

$$W = \frac{m_0 \cdot c^2}{\sqrt{1-\frac{v^2}{c^2}}} = \frac{m_0 \cdot c^3}{\sqrt{c^2 - v^2}} \quad (9)$$

One note with ΔW, the difference between the energy W (for a velocity v and a mass m) and the rest energy W_0 (when the velocity v=0 and the corpuscle mass become the rest mass, m_0):

$$\Delta W = W - W_0 = m \cdot c^2 - m_0 \cdot c^2 = m_0 \cdot c^2 \cdot \frac{c - \sqrt{c^2 - v^2}}{\sqrt{c^2 - v^2}} =$$

$$\frac{m_0 \cdot c^2 \cdot v^2}{\sqrt{c^2 - v^2} \cdot (c + \sqrt{c^2 - v^2})} = \frac{m_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} \cdot \frac{1}{1 + \sqrt{1 - \frac{v^2}{c^2}}} \quad (10)$$

The kinematical force (Lagrange Force) can be written in the (3) form:

$$F_c = m \cdot \frac{dv}{dt} + \frac{1}{2} \cdot v \cdot \frac{dm}{dt} \quad (3)$$

See the difference between this force, (kinematical force) and the general force (relation 2).

The kinematical elemental energy of a corpuscle can be written in form (4'):

$$dE = dL = F_c \cdot ds = m \cdot \frac{dv}{dt} \cdot ds + \frac{1}{2} \cdot v \cdot \frac{dm}{dt} \cdot ds = m \cdot v \cdot dv$$

$$+ \frac{1}{2} \cdot v^2 \cdot dm = \frac{1}{2} \cdot m \cdot d(v^2) + \frac{1}{2} \cdot v^2 \cdot dm = \frac{1}{2} \cdot d(m \cdot v^2) \quad (4')$$

Integrating the relation (4') the kinematical energy, E, takes the form (11), (where the integration constant=0, when E=0 and m=0):

$$E = \frac{1}{2} \cdot m \cdot v^2 \quad (11)$$

And with Lorentz expression (5), the kinematical energy, E, take the form (12):

$$E = \frac{m_0 \cdot c \cdot v^2}{2 \cdot \sqrt{c^2 - v^2}} \quad (12)$$

One can see easily, that ΔW energy is greater than E energy (kinematical energy), (relation 13):

$$\Delta W \geq E \quad (13)$$

ΔW energy is a sum between energy E and ΔE. We know ΔW and E, and one calculates ΔE like a difference between ΔW and E:

$$\Delta E = \Delta W - E = \frac{m_0 \cdot c \cdot v^2}{\sqrt{c^2 - v^2}} \cdot \left(\frac{1}{1+\sqrt{1-\frac{v^2}{c^2}}} - \frac{1}{2}\right) =$$

$$\frac{m_0 \cdot c \cdot v^2}{2 \cdot \sqrt{c^2 - v^2}} \cdot \frac{1-\sqrt{1-\frac{v^2}{c^2}}}{1+\sqrt{1-\frac{v^2}{c^2}}} = E \cdot \frac{1-\sqrt{1-\frac{v^2}{c^2}}}{1+\sqrt{1-\frac{v^2}{c^2}}} \quad (14)$$

The relation (14), ΔE, represents the difference between the ΔW (a difference of Einstein energy) and the kinematical energy, E (Lagrange Energy). This difference, ΔE, would be the energy which increase the corpuscle mass, from the rest mass, m_0, to mass m, when the particle speeds from rest velocity, v=0, to v.

-for the velocity v=0, ΔE=0, and ΔW=E;

-for the velocity v=c, ΔE=E, and $\Delta W = E + E = 2 \cdot E$;

ΔE∈[0,E] and ΔW∈[E,2E]

Conclusions

When ΔW become the double of kinematical energy, E, ($\Delta W = 2 \cdot E$), and ΔE become E, the speeded corpuscle take the constant velocity of light, c, and become a particle without electric load.

R E F E R E N C E S

1. *M. Petrescu-Prahova, I. Petrescu-Prahova,* ş.a., "Fizica-Manual pentru anul IV liceu, secția reală." Editura Didactică şi Pedagogică, Bucureşti, 1976.

2. *D. Ciobotaru, ş.a.*, "FIZICA - Manual pentru clasa a XII-a." EDP, Bucureşti, 1994.