$E=MC^2$ CRITIQUE

James A. Putnam

Einstein's equation is interpreted by embracing a theoretical disconnection. It is said to establish that mass and energy are essentially alike. They are just different expressions of the same thing. This 'thing' is commonly referred to as energy. There is no support for this interpretation contained within the equation. There is no support for it in the fundamentals used to derive the equation. Einstein insisted its support was demonstrated in radioactive processes. He stated that: "The equivalence of mass at rest and energy at rest as expressed by $E=mC^2$ has been confirmed in many cases..."

So Einstein believed energy could be at rest. Since energy is defined as the measurement of a force applied across a distance (force times distance), this is analogous to saying: The measurement of a force applied across a distance can exist at rest. This is an example of a theoretical disconnection. Instead of energy being a quantitative measurement, it is arbitrarily assigned the status of having a material existence. In Einstein's theory, and even more generally since then, energy is simply assumed to have physical substance. This is not empirical knowledge.

Empirical evidence cannot be used to support this conclusion. We can only apply force and not energy. We can only observe changes in velocity and not changes of an energy substance. Energy exists only in today's theoretical speculations about the mysterious unknown realm of the universe that we call *cause*. In many ways, theoretical physics relies upon artificial, even hidden, explanations of why events occur. It is lack of understanding that is being hidden.

It is my position that both the form and interpretation of $E=mC^2$ results from fundamental errors. I demonstrate a change of form and interpretation in detail in the body of the theory. Here I present an introductory reinterpretation. It is intended to show that Einstein's equation, even in its familiar form, is susceptible to reinterpretation. Beginning with the definition of energy:

$$E = \int f dx$$

Einstein's equation can be written as:

$$E = \int f dx = mC^2$$

If the force is constant, then:

$$\int f dx = fx$$

A constant force is used to derive Einstein's energy equation. Therefore:

$$fx = mC^2$$

Looked at in this way, the equation gives recognition to the fact that matter is defined by its property of force. Instead of reading Einstein's equation as representing the maximum amount of energy, the equation is saying there is a maximum amount of force available from a particle at rest. What is the connection between this maximum amount of force and the term mC^2? The answer lays in a demonstration that mC^2 actually represents a value of mass times acceleration times distance. Therefore C^2 is, in part, representing a maximum acceleration achievable due to the maximum, or total, force available.

It is known what can be the maximum possible acceleration. An object can only be accelerated to the approximate speed of light. The question to be answered is: What is the minimum distance over which this maximum acceleration can be achieved? That distance is the length of a photon. Photons cause a change of velocity and can, therefore, be modeled as having length. The definition of energy requires that the photon cause a force to be exerted over a distance. Force times a point gives us nothing. The term C^2 is the mathematical equivalent of the maximum possible acceleration times the length dx_c of the photon:

$$C^2 = a_{max}\, dx_c = \frac{dv_{max}}{dt} dx_c$$

The magnitude of dt is a specific value for this example. The shortest possible time for the maximum change of velocity to occur is the period of time it takes for a photon to pass a given point. Adding this criterion to the equation:

$$C^2 = a_{max}\, dx_c = \frac{dv_{max}}{dt_c}\, dx_c$$

The maximum possible change of velocity is from zero to the speed of light. Therefore, the expression on the right side can also be written as:

$$\frac{dv_{max}}{dt_c}\, dx_c = \frac{C}{dt_c}\, dx_c$$

It can also be seen that:

$$\frac{dx_c}{dt_c} = C$$

Therefore:

$$\frac{C}{dt_c}\, dx_c = C\,\frac{dx_c}{dt_c} = C^2$$

So, the maximum acceleration times the shortest possible distance is:

$$\frac{dv_{max}}{dt_c}\ dx_c = \frac{C}{dt_c}\ dx_c = C\ \frac{dx_c}{dt_c} = C^2$$

Therefore:

$$E = fx = f_{max}\ dx_c = m\frac{dv_{max}}{dt_c}dx_c = mC^2$$

Writing an equation that includes all pertinent expressions of the total energy:

$$E = E_{total} = mC^2 = f_{max}dx_c = m\frac{dv_{max}}{dt_c}dx_c = ma_{max}dx_c$$

This string of equalities demonstrates the physical meaning of mC^2.