

On the Strange Concept of Rest Mass Energy

Rest Mass Energy will be derived from the Special Relativity (SRT) Interval equation and its significance examined.

Both Newtonian Mechanics (NM) and SRT are derivable from the same Interval equation, namely

$$x'^2 + I^2 = H^2$$

where x' is the distance an object has moved away from $x=0$ during the time t and I is the distance the *perpendicular portion* of a light beam moved away from $x=0$ during the time t at speed c , the speed of light, i.e., $I=ct$. H^2 is simply the sum of those squares and H is the distance between the location of that light beam and the object after the time t . If the light beam moved 'vertically' the distance I , then from the object's point of view the light beam moved not only vertically but also horizontally and after time t is now the distance H away. Since $H>I$, NM says H/t is greater than $(I/t)=c$ so $H/t>c$, call it c' . Therefore,

$$H=c't$$

SRT says light *always* travels at speed c so, since $H>I$, then H is made into

$$H=ct'$$

which is where the 'dilated' time of SRT originates. All equations and concepts of SRT follow from this change of $c't$ to ct' .

Other equations that will be needed are

$$\gamma = ct'/I = c't/I; \quad v = x'/t; \quad u = x'/t'; \quad v = \gamma u; \quad P = m\gamma u = mv; \quad (v/c)^2 = \gamma^2 - 1$$

$$I^2 = (ct)^2 - x^2 = (ct')^2 - x'^2 = (ct'')^2 - x''^2 = \dots; \quad I = ct \text{ when } x=0$$

where γ is the gamma function, v is NM speed, u is SRT speed, P is momentum, and m is mass. The v and u *never* have the same value. The correctness of these equations has been established elsewhere.

So the Interval equations for SRT and NM are:

SRT

$$x'^2 + I^2 = (ct')^2; \quad (ct')^2 - x'^2 = I^2$$

Multiply both sides by $(mc/t)^2$.

$$(mc^2t'/t)^2 - (mcx'/t)^2 = (mcI/t)^2$$

$$(\gamma mc^2)^2 - (mcx'/t)^2 = (mcc/t)^2$$

$$(\gamma mc^2)^2 - (Pc)^2 = (mc^2)^2$$

$$E^2 - (Pc)^2 = (mc^2)^2 = (E_0)^2$$

$(mc^2) = (E_0)^2$ is SRT rest mass energy

NM

$$x'^2 + I^2 = (c't)^2; \quad (c't)^2 - x'^2 = I^2$$

Multiply both sides by $(mc^2/ct)^2$.

$$(mc^2c't/ct)^2 - (mc^2x'/ct)^2 = (mc^2I/ct)^2$$

$$(\gamma mc^2)^2 - (mcx'/t)^2 = (mc^2ct/ct)^2$$

$$(\gamma mc^2)^2 - (Pc)^2 = (mc^2)^2$$

(mc^2) could also be considered NM 'rest mass energy' but makes no sense.

Although 'rest mass energy', as shown above, "exists" in both SRT and NM, is it ever considered in NM? Perhaps the concept should be examined further.

$$(Pc)^2 = (\gamma mc^2)^2 - (mc^2)^2$$

$$(P/c)^2 = \gamma^2 m^2 - m^2$$

$$(P/c)^2 = m^2(\gamma^2 - 1)$$

$$(P/c)^2 = m^2(v/c)^2$$

$$(P/c) = m(v/c); \quad P = m v = m\gamma u$$

$$(Pc)^2 = (\gamma mc^2)^2 - (mc^2)^2$$

$$(P/c)^2 = \gamma^2 m^2 - m^2$$

$$(P/c)^2 = m^2(\gamma^2 - 1)$$

$$(P/c)^2 = m^2(v/c)^2$$

$$(P/c) = m(v/c); \quad P = m v$$

Perhaps someone should have finished their algebra. So-called Rest Mass Energy seems to be the result of not recognizing that as velocity, u or v , approaches 0, γ approaches 1.0 which must be 'corrected' so that when u or v is zero, P will also equal zero.