Reply to 'Rebuttal to M.E. Hassani's Foundations of Superluminal Relativistic Mechanics'

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Abstract: It has been critically argued by A. Sfarti [Communications in Physics, Vol.28, No.2 (2018), pp.189-190] that my paper 'Foundations of Superluminal Relativistic Mechanics' is wholly incorrect because it is based on a wrong premise. A careful study of the rebuttal reveals however a failure to correctly address the key idea on which my work is based. There is therefore no proof advanced of any alleged incorrectness in my work. Furthermore, the lack of mathematical rigour reinforced with the mathematical errors contained in the aforementioned rebuttal paper has hugely amplified the invalidity of the supposed disproof.

Keywords: superluminal relativistic mechanics, relativistic mechanics, disproof

1. Introduction

The recent rebuttal paper [1] by Andrian Sfarti has not correctly addressed the key idea on which my work *was* and *is* based to prove the whole incorrectness of my paper 'Foundations of Superluminal Relativistic Mechanics'[2]. The main reason that eventually led the author to the erroneous disproof has been identified – it is the misunderstanding of my paper [2] *through* the lack of mathematical rigour reinforced with the mathematical errors contained in the aforementioned rebuttal paper which has hugely amplified the invalidity of the supposed disproof as we shall see soon.

2. The author's misunderstanding

In order to make our scrutiny more comprehensible, we are obliged to rewrite the author's central claim, word by word. In his rebuttal paper, the author wrote: «*The starting point of M. Hassani's paper is the statement that [1]*: "*In order to avoid this singularity, one can simply prohibit the existence of luminal inertial reference frames (IRFs), that is to say, a set of inertial frames that may be in rectilinear uniform motion at luminal velocity relative to each other. But such a prohibition seems to be entirely unreasonable because in the Nature; none can prevent any free material body from reaching or exceeding light speed in vacuum.* "

The last sentence is the basis of the Hassani paper and it can be proven false by a simple application of dynamics. »

Let us provide the evidence of the fact that the above paragraph shows us more conclusively that the author has misunderstood the paper 'Foundations of Superluminal Relativistic Mechanics' [2]. The key idea on which the 'Foundations of Superluminal Relativistic Mechanics' was and is based is explicitly mentioned in the Abstract of the paper [2] as follows: " *The paper provides an elementary derivation of new superluminal spatio-temporal transformations based on the idea that, conceptually and kinematically, each subluminal, luminal and/or superluminal inertial reference frame has, in addition to its relative velocity, its proper specific kinematical parameter, which having the physical dimensions of a constant speed ...*"

Also the same key idea is explicitly mentioned in the Introduction of the paper [2] as follows:

"*Thus, our principal motivation behind the present work is to provide a crucial elementary derivation of new superluminal spatio-temporal transformations (STs) based on the idea that, conceptually and kinematically, each subluminal* ($-c < v < c$)*, luminal* ($v = c$) *and/or superluminal* ($v > c$) *inertial reference frame has, in addition to its relative velocity, its proper specific kinematical parameter (SKP), which having the physical dimensions of a constant speed*."

– One could recognize that the "*specific kinematical parameter (SKP), which having the physical dimensions of a constant speed*." is the key idea on which *was* and *is* based the paper [2], and this key idea is completely different from that allegedly claimed by the author of the rebuttal paper [1]. Hence, this proves the author's misunderstanding.

3. The failure of the author's rebuttal

In his rebuttal paper [1], Section II Disproof, the author did not make the calculations in the context and the formalism of the paper [2], that's, the 'superluminal relativistic mechanics' ($v \geq c$), but instead he did the calculations in the context and formalism of the 'relativistic mechanics' ($v < c$). Consequently, we cannot consider the calculations as disproof.

In spite of the fact that the author's rebuttal has nothing to do with the paper [2], it is also obvious that even the author's calculations are highly questionable because, firstly, the author failed to inform the reader about the context and the formalism used by him –the relativistic mechanics was not explicitly or tacitly mentioned at all, secondly, he made mistakes in his calculations.

On page 190, Section II Disproof, the author wrote: «*The mechanical work exerted on a particle of mass over a distance L by a force F is*:

$$W = \int_{r=0}^{r=L} F dr . \quad (1)$$

We know that:

$$F = \frac{dp}{dt} = \frac{d(v\gamma v)}{dt} . \quad (2)$$

Thus

$$\begin{aligned} W &= \int_{r=0}^{r=L} m \frac{d\,(v\gamma(v))}{dt} dr \\ &= \int_{v=0}^{v=V} d\,(v\gamma(v)) \frac{dr}{dt} \\ &= m \int_{v=0}^{v=V} v\, d\,(v\gamma(v)) \end{aligned} \quad (3)$$

When r varies from 0 *to L the speed varies from* 0 *to V. we know that*:

$$d\,(v\gamma(v)) = \gamma^3(v)dv\,. \tag{4}$$

So

$$W = m\int_{v=0}^{v=V} v\gamma^3(v)dv = mc^2(\gamma(V) - (0))\,. \tag{5}$$

For V = c, $\gamma(V) = \infty$ *and* $W = \infty$ *so the starting point of Hassani's paper is wrong.*»

a) As we have already seen, in addition to the fact that the author's rebuttal has nothing to do with the paper [2], the above author's disproof is highly questionable mathematically and physically. The author failed to explicitly or tacitly mention the context and the formalism in which the calculations are performed.

b) Eq.(2) is mathematically and physical wrong.

c) Since the author did not mention the context and the formalism, the reader can legitimately ask the following questions: What is the explicit expression of p? What is the explicit expression of γ ?

d) Since Eq.(2) is mathematically and physically wrong and the expressions of p and γ are unknown, therefore, rigorously speaking the author cannot derive Eqs.(3), (4) and (5) from Eq.(2).
In fact, the author performed his calculations in the context and the formalism of relativistic mechanics ($v < c$), and the correct expression of Eq.(2) is $\mathbf{F} = (d\mathbf{p}/dt) = d(\gamma m\mathbf{v})/dt$ that's the relativistic momentum $\mathbf{p}$ is defined by $\mathbf{p} = \gamma m\mathbf{v}$, where $\mathbf{v}$ and m are, respectively, the velocity (vector) and the mass of the hypothetical test-particle, and $\gamma \equiv \gamma(v) = (1 - v^2/c^2)^{-1/2}$ with $v < c$ is the Lorentz factor. But, as we know, the author *deliberately* failed to mention all that. Why? Because in order to disproof the paper [2], the author *was* and *is* obliged to perform his calculations in the context and the formalism of superluminal relativistic mechanics ($v \geq c$).

4. Refutation of the author's disproof in the context and the formalism of superluminal relativistic mechanics.

Now, let us disprove the author's disproof in the context and the formalism of superluminal relativistic mechanics (v ≥ c). Actually, an expression for the superluminal (relativistic) kinetic energy has already been obtained in [2], nevertheless, we will rederive it as follows: We have, according to the paper [2], the specific kinematical parameter (SKP), which has the physical dimensions of a constant speed defined as:

$$\begin{cases} \vartheta(v) = c\,, & -c < v < c \\ \vartheta(v) > v\,, & c \leq |v| < \infty\,. \\ \vartheta^2(-v) = \vartheta^2(v), & \forall v \end{cases} \tag{i}$$

The superluminal (relativistic) momentum and total energy are, respectively, defined by

$$\mathbf{p} = \frac{\mathscr{E}}{\vartheta^2}\mathbf{v}, \quad \vartheta \equiv \vartheta(v) \tag{ii}$$

and

$$\mathscr{E} = \eta \mathscr{E}_0 , \tag{iii}$$

where $\eta \equiv \eta(v) = 1/\sqrt{1 - v^2/\vartheta^2}$, $c \le v < \vartheta$ and $\mathscr{E}_0 = mc^2$ is the rest mass energy of the hypothetical test-particle.

As in classical mechanics, we will define the superluminal (relativistic) kinetic energy K as the work done by a net force **F** an accelerated hypothetical test-particle of mass *m* from relative rest to some superluminal velocity $v \ge c$.

$$\mathrm{K} = \int_{\mathbf{r}=0}^{\mathbf{r}} \mathbf{F} d\mathbf{r} = \int_{\mathbf{v}=0}^{\mathbf{v}\ge\mathbf{c}} \frac{d\mathbf{p}}{dt} d\mathbf{r} = \int_{0}^{\mathbf{v}\ge\mathbf{c}} \mathbf{v} d\left(\frac{\mathscr{E}}{\vartheta^2}\mathbf{v}\right). \tag{iv}$$

Since $\vartheta \equiv \vartheta(v)$ is, by definition, having the physical dimensions of a constant speed, thus by taking into account the expression (iii), we can rewrite (iv) as follows:

$$\mathrm{K} = \frac{\mathscr{E}_0}{\vartheta^2} \int_{0}^{\mathbf{v}\ge\mathbf{c}} \mathbf{v} d(\eta \mathbf{v}). \tag{v}$$

The computation of the integral in (v) is not difficult but requires a bit algebra. Noting

$$d(\eta \mathbf{v}) = d[(1 - v^2/\vartheta^2)^{-1/2}\mathbf{v}] = d[(1 - \mathbf{v}^2/\vartheta^2)^{-1/2}\mathbf{v}] = (1 - \mathbf{v}^2/\vartheta^2)^{-3/2} d\mathbf{v},$$

substituting this into (v), we obtain:

$$\mathrm{K} = \frac{\mathscr{E}_0}{\vartheta^2} \int_{0}^{\mathbf{v}\ge\mathbf{c}} (1 - \mathbf{v}^2/\vartheta^2)^{-3/2} \mathbf{v} d\mathbf{v} = \mathscr{E}_0[(1 - \mathbf{v}^2/\vartheta^2)^{-1/2} - 1], \tag{vi}$$

or equivalently

$$\mathrm{K} = \eta \mathscr{E}_0 - \mathscr{E}_0 = \mathscr{E}_0(\eta - 1). \tag{vii}$$

5. Conclusion

The author's rebuttal in [1] has been shown not only wrong, but simply meaningless in view of the fact that the alleged disproof has nothing to do with the paper [2].

References

[1] A. Sfarti, Communications in Physics, Vol. 28, No.2 (2018), pp. 189-190
[2] M.E. Hassani, Communications in Physics, Vol.24 , No.4 (2014), pp. 313-332