REPORT #1 Szabo: On the meaning of Lorentz covariance

The special theory of relativity is nearly 100 years old. As the first of the theories of modern physics it has been subject to exhaustive scrutiny and the standard interpretation of the theory has survived massive critical attack. In pointing this out, I do _not_ intend to dismiss discussion of non-standard interpretations out of hand. But I do intend it to underscore the need for someone advancing a non-standard interpretation to mount strong and thorough arguments and to make some contact with the existing literature of criticism. The author does neither. There is little if any discussion of similar proposals in the literature. (The author's proposal reminds me of Lorentzian electrodynamics without an ether state of rest.) Worse, the argument for the central claim is so brief as to be unintelligible to me.

I could find only two paragraphs in which the author argues that the Lorentz boost is not (loosely speaking) the original system set into uniform motion.

The first comes at the bottom of p.8 in the discussion of the Lorentz boost of a system of particles at rest. The system is at rest at an initial instant t=0 and for all times thereafter. Following the standard application of the Lorentz transformation, the boosted system consists of particles in uniform motion, time dilated and spatially contracted, with the initial instant spread over time according to the relativity of simultaneity. The author remarks on the boosted system (with my comments

interleaved):

> Thus, in this particular case, the system described by the
> new solution we obtained from the Lorentz covariance of the
> original equations, is leastwise very similar to the
> original system when it moves, as a whole, at velocity v,
> and the usual relativistic phenomena like the Lorentz
> contraction and the time dilatation seem to be
> reconstructed. This, however, is an illusion. The solution
> belonging to the initial conditions (35)-(36) is not a
> simple superposition of the original motion of the system
> and a collection translation at velocity v--as was the case in
> (17) [Galilean boost] ...

At this point, we just have the remark that the Lorentz boosted system is not a Galilean boosted system. But surely the author does not intend that remark to establish that a Lorentz boost does not yield the original system set into uniform motion. The transformation that sets systems into uniform motion must be adapted to the relevant spacetime. The Galilean boost is adapted to a Newtonian space and not to a Minkowski spacetime. If the author intends us to accept that the Galilean boost must also be the one to be used in a Minkowski spacetime, we surely need some account of what we are looking for in a the system that is set into uniform motion. The usual account is that co-moving observers for the original and moving system report identically. One can make that less anthropomorphic by replacing co-moving observers with co-moving measuring instruments of whatever kind you like. They must measure the same results. The Lorentz boost boost satisfies this condition in a Minkowski spacetime. The Galilean boost does not satisfy this condition and so is inadmissible as the transformation that sets systems into uniform motion.

> ...For (38) [description of motion of boosted particles]
> describes the motion of the particles only for t > [boosted
> initial instant]. Before that time there is a deformation of
> the system, since the particles start their motions at

> different moments of time from various places...

This is obscure to me. The original system was described only for times t>0, so the boosted system is described only for times t > [boosted initial instant] . So the example gives no basis to claim a deformation or anything else happened prior to this time. Indeed it is unclear what is meant by deformations at all. Are they length contractions, time dilations, accelerations, what? And what is their significance? If we have to make some assumption about what happened prior to the initial instant, why would it not just be more of the same: the particles in the original system are at rest; so the boosted particles are in uniform motion?

> ...The truth is that there are many different initial
> conditions and many corresponding solutions
> which could be, intuitively, regarded as "like the original
> system when it is moving as a whole" and the Lorentz
> covariance does not guarantee that the one we obtained is
> the right one.

This is a very strong claim. It says, in effect, that there are many perfectly admissible candidates for the original system set into uniform motion. At this point a lot depends on what we mean by the system set into uniform motion. If, as is standard, we mean a system that appears identical to co-moving observers/measuring instruments, then I have seen no argument at all for the claim. The Lorentz boost of the system is the only system I know that assures us that all co-moving measurements will have the same outcomes. Another system--say one that is not Lorentz contracted--will not have this property. Why should I believe that there are other systems without this problem? If the author does not intend the moving system to yield identical results from co-moving measurements, they why should we regard that system as being the original set into uniform motion? Co-moving observers would certainly regard them to be different.

The second paragraph in which the author argues that the Lorentz boost is not the original system set into uniform motion comes at the bottom on p.9. The author considers a more general example of a system of moving particles

set into uniform motion. The author writes of the Lorentz boosted system:

> It is difficult to tell what the solution belonging to such
> a complex initial condition is like, but it is not expected
> that it describes something similar to the original system in
> collective motion a the velocity (0,0,v).

Certainly the Lorentz boost of a complicated system will be complicated. But just remarking that it is hard to analyze is no reason to doubt that it represents the original system set into uniform motion. If the system is the Lorentz boost of the original system, for example, then no matter how complicated it is we are assured that all co-moving measurements will give the same results, no matter how complicated the co-moving measurements.

As far as I can tell, the paragraphs quoted above contain the totality of the author's argument that the Lorentz boost does not yield the original system set into uniform motion. I am unable to find a cogent argument in them for the claim made.

Two minor points:

Example 1 describes a system of electric particles interacting solely electromagnetically and nonetheless in static equilibrium. Readers will wonder how such systems are possible. I can only think of a highly contrived infinite system.

A great deal of the paper is spent on routine calculations in special relativity. I think the author can presume that readers know how to apply the Lorentz transformation. That same space would be better spent arguing for the novel theses.