REPORT#3
Report of Referee on "On the meaning of Lorentz covariance"
by L. Szabo

The author has prepared a thoughtful analysis of the relationship between the relativity principle and Lorentz covariance. However, he has made certain assumptions about the significance of how "...these physical properties are modified when the object is in motion." (His phrase in the introduction.) In particular, if I understand his argument correctly, he is proposing that if Lorentz covariance is true, then the Lorentz transformed analysis of the states of individual atoms defining a rod, R, at rest in K, using the simultaneity of K, his (29). (30), ought to be equivalent to one starting from rest in K', say R', using K' simultaneity, his (32), (33). However, the non-invariance of simultaneity leads to the transform of R to (35), (36), say R'', which is {\em not} rigid in K' and {\em not} therefore the same physical system as R'. He then discusses a time evolution involving "dissipation" which will eventually relax R'' to one that is rigid in K'. I am not sure if I am correctly describing the author's argument. If I am, however, his main point is equivalent to saying that if acceleration is not zero, then a rod which is rigid in K will not be in K' and the reverse. This is, I believe fairly well known, and does not in any way affect the validity of Lorentz covariance. In fact, in my opinion the relativity principle stated as "the laws of physics (including maxwell's) must be valid in the same form in all IRF's" and Lorentz covariance, "transform from one IRF to another by the usual Lorentz transformations" are not in any way affected by such practical considerations. Both are {\em formal} conditions: the {\em form} of the Maxwell equations and relativistic mechanics {\em is} preserved by the Lorentz transformations, so Lorentz covariance does lead to the POR. The converse is true, by the usual arguments (adding homogeneity and flat geometry, of course). Actually, as I understand it, standard lengths are no longer defined by some standard rigid rod, but rather by standard clocks and the setting of a fixed number for c.

Finally, there is always the problem of trying to understand accelerated systems within the context of the principle of special relativity. By definition, such reference frames fall outside this principle, and Lorentz covariance. While the author does not explicitly refer to an accelerated RF, his treatment of an accelerated rod, used as a standard, constitutes at least a partial definition of an accelerated frame.

Before recommending publication, I would like to get the author's reaction to these points.