THE RELATIVISTIC CENTER OF MOMENTUM

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Abstract. Since Pryce's 1948 study of the relativistic center of momentum it is believed that the classical notion of the center of mass can be extended to special relativity theory only in "at least one Lorentz frame" (in Goldstein's words). The aim of this work is, accordingly, to study the relativistic center of mass in a way fully analogous to its Newtonian counterpart.

1. Introduction and Historical Notes

In 1948 Pryce [4] reached the conclusion that "there appears to be no wholly satisfactory definition of the (relativistic) mass-centre". He thus raised an important problem in relativistic mechanics that extends to the present day.

Gyrovector space theoretic techniques, however, allow the relativistic center of momentum to be determined uniquely in a way fully analogous to its Newtonian counterpart. Furthermore, the resulting relativistic center of momentum enjoys all the attractive features that the Newtonian one does.

In Newtonian mechanics the notion of the center of mass arises naturally in the study of motion of isolated systems of particles. Lehner and Moresch [3] stated in 1995:

> *The notion of center of mass, however, does not have a direct extension to relativistic mechanics and several studies ... on this topic have been made to define such extension through different approaches (references omitted).*

> *L. R. Lehner and O. M. Moresch, 1995*

Rowe therefore informed in a book that he had almost completed writing when his life was brutally terminated in the Yemen in December 1998 [5, p. 111]: