# Higher order extensions of the Poincaré algebra

M. Rausch de Traubenberg*

*IPHC-DRS, UdS, CNRS, IN2P3; 23 rue du Loess,*

*Strasbourg, 67037 Cedex, France*

**Abstract**

Lie algebras of order $F$ (or $F-$Lie algebras) are possible generalisations of Lie algebras ($F = 1$) and Lie superalgebras ($F = 2$). An $F-$Lie algebra admits a $\mathbb{Z}_F-$gradation, the zero-graded part being a Lie algebra. An $F-$fold symmetric product (playing the role of the anticommutator in the case $F = 2$) expresses the zero graded part in terms of the non-zero graded part. This structure enables us to define various non-trivial extensions of the Poincaré algebra. These extensions are study more preciselly in two different contexts. The first algebra we are considering is shown to be an (infinite dimensional) extension of the Poincaré algebra in $(1 + 2)-$dimensions and turns out to induce a symmetry which connects relativistics anyons. The second extension we are studing is related to a specific finite dimensional Lie algebras of order $F$ in any space-time dimensions and induces a symmetry on $p-$forms. We then summarized some of the main results obtained in that context. Finally, we show that one is able to associate a group to these structures.

*e-mail: Michel.Rausch@IReS.in2p3.fr