Commun. math. Phys. 47, 33—42 (1976)

Communications in
Mathematical
Physics

On Lorentz Invariant Distributions

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Abstract. n-point Lorentz invariant tempered distributions with the supports for one-point only in $\bar{V}_+^\mu$ are described.

1. Introduction

Lorentz invariant one-point distributions were extensively investigated by P.-D. Methée [1–2]. n-point Lorentz invariant tempered distributions with supports for one-point only in $\bar{V}_+^\mu$ were studied by K. Hepp [3]. In this case the problem of the description of Lorentz invariant distributions is equivalent to the description of the rotation invariant tempered distributions of n three-vectors. For $n=1, 2$ this problem was solved [3]. Rotation invariant distributions and the Lorentz invariant distributions were represented as distributions on the space of the SO(3)-invariants and conformably on the space of the $L_+^\uparrow$-invariants. In trying to generalize Hepp's results to $n>2$ one encounters the difficulty that the space of the $L_+^\uparrow$-invariants (and the SO(3)-invariants) is an algebraic variety with singularities, on which no reasonable spaces of testing functions have yet been defined [3].

In present paper SO(3)-harmonic analysis on the space $S'(R^3)$ is studied. Taking advantage of this analysis it is possible to describe the rotation invariant tempered distributions. As stated above the Lorentz invariant tempered distributions with supports in $\bar{V}_+^\mu \times R^{4n}$ were connected with the rotation invariant distributions. Hence we obtain the description of the Lorentz invariant distributions belonging to the space $S'(\bar{V}_+^\mu \times R^{4n})$.

The plan of this paper is as follows: Section 2 contains SO(3)-harmonic analysis on $S'(R^3)$; in Section 3 rotation invariant tempered distributions were studied. The Lorentz invariant distributions belonging to $S'(\bar{V}_+^\mu \times R^{4n})$ are under consideration in Section 4.