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Local Relativistic Invariant Flows for Quantum Fields

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Abstract. For quantum fields with trigonometric interaction in arbitrary space dimension we construct a representation of the Lorentz group by automorphisms on a Banach space generated by the Weyl algebra.

1. Introduction

It is well known that for systems with infinitely many degrees of freedom the problem of the formulation of the dynamics is intimately connected with the "kinematical problem" of finding a suitable representation of the basic operators of the theory. The problem as stated above has been discussed both in physical and mathematical works, see e.g. the basic early work [20, 21, 23, 24, 29, 34]. From a mathematical point of view the problem has been seen as the one connected with the phenomenon of equivalence versus singularity of measures on function space, and has been discussed extensively in this way, see e.g. [26, 45, 48]. Nevertheless, despite this basic physical and mathematical problem, since the very beginnings of quantum field theory, the canonical formalism has been for a long time the most fascinating point of reference (see e.g. Dirac [18] and especially Heisenberg and Pauli [28] but also Wentzel [46]). It is certainly the most ambitious program for field quantization in as much as it is an attempt to give a direct extension of the quantum mechanics of finitely many degrees of freedom to the case of systems of infinitely many degrees of freedom. The canonical program was pursued further in the late fifties especially by Coester and Haag [12], Araki [8], Klauder [31], Streater [42], and Segal [38]. The difficulties of the canonical formalism (Haag's theorem [27, 43], which prevents the free and interacting fields to be in the same representation of the canonical commutation relations) are well known and have to be bypassed, when starting in Fock space, by suitable limit procedures. Only in the sixties and in the last decade models satisfying the basic postulates of locality and relativistic invariance have been constructed (see any of an excellent series of surveys on constructive quantum field e.g. [41, 25]), and indeed the basic