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Two and Three Body Equations in Quantum Field Models*

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Abstract. In each pure phase of a $\mathscr{P}(\phi)_2$ quantum field model, we establish local regularity of the Green's functions and exponential decay for noncritical models. We establish the existence of two-particle and three-particle Bethe-Salpeter kernels in the Euclidean region.

Contents

1. Introduction

The study of particles in weakly coupled $\mathscr{P}(\phi)_2$ quantum field theories was begun in [25, 26]. The cluster expansions developed in these papers resulted in the construction of isolated one-particle states. According to the Haag-Ruelle theory, the existence of n-particle in and out states, and the existence of an isometric S-matrix, follow from the existence of isolated one particle states. The ϕ^4 model, in the single phase region, has been shown to be repulsive in the sense that no even mass spectrum occurs in the two particle bound state interval $(m, 2m)$ [46, 8, 25]. The presence of bound state mass spectrum was indicated for the $\phi^6 - \phi^4$ interaction [25]. Spencer [47] and Spencer and Zirilli [48] have a more detailed analysis of the energy momentum spectrum for weak coupling, which goes up to the threshold $E \leqq 3m - \varepsilon$, and uses the Bethe-Salpeter equation. An early version of their work motivated the present paper.

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