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The Wightman Axioms for the Weakly Coupled Yukawa Model in Two Dimensions

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Abstract. We prove the convergence of a cluster expansion for the weakly coupled Yukawa model in two dimensions.

I. Introduction and Results

The purpose of this paper is to prove the convergence of a cluster expansion [8, 3] for the Yukawa model in two dimensions[1]. We use here the model as defined by Seiler [13] and McBryan [10], and we shall use the presentation of Seiler and Simon [14].

The Yukawa model has been also studied by Glimm [4], Glimm and Jaffe [5] and [6], Schrader [12], Brydges and Federbush [2] and Brydges [1].

In this introduction we define the problem and state the main results, in the second chapter we define and give the properties of our main tool: a set of decoupling functions allowing to do the cluster expansion—see also [9]—, in the last chapter we prove the convergence of the cluster expansion.

Let us give some definitions, see [14].

The partition function in a volume Λ is:

$$Z_\Lambda = \int d\mu \det_{\text{ren}}(1+K_\Lambda)\,. \tag{I.1}$$

The unnormalized Schwinger functions in a volume Λ are:

$$S_\Lambda(f_1, \ldots, f_n; g_1, \ldots, g_N; h_1, \ldots, h_N)$$
$$= \int d\mu \left\{ \det_{ik} S_F\left((P^2+m^2)^{-1/4} g_i, \frac{\not{P}+m}{(P^2+m^2)^{3/4}} h_k \right) \right\} \prod_{l=1}^{n} \varphi(f_l) \det_{\text{ren}}(1+K_\Lambda)$$

where:

$$S_F(g', h') = \left(g', \frac{1}{1+K_\Lambda} h' \right)_{L^2}$$

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[1] A. Cooper and L. Rosen have shown also the same result [17]