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Scattering States of Charged Particles in the $\mathbb{Z}_2$ Gauge Theories

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Abstract. Scattering states of charged particles in a massive Euclidean lattice gauge model are constructed.

1 Introduction

The particle spectrum of Euclidean Quantum Field Theories on the lattice has been the object of extensive studies in various models (see [2, 10] for references). Recently, under general assumptions (essentially existence of a transfer matrix and mass gap), a full construction of the scattering states for particles of the vacuum sector of those theories has been performed [3] following the ideas of Haag and Ruelle [7, 8]. This work extends the main result of [3], namely the construction of multiparticle states, to the charged particles of the $\mathbb{Z}_2$ Higgs model whose existence has been shown in [2]. The construction presented here depends in some details on particularities of this model but they might certainly be adapted in its essential tools to other massive models involving charged particles. In the general framework of relativistic quantum fields the construction of the scattering states of charged particles in massive theories was performed in [9].

As in [3], the main problem to be overcome is the lack of locality (Einstein causality) of the real-time evolution. Following [3] we by-pass this problem by making use of the exponential decay of certain Euclidean correlations, a fact related to the existence of a mass gap in the spectrum of the Hamiltonian operator.

1.1. The Model and Previous Results

The $\mathbb{Z}_2$ gauge-Higgs lattice model is particularly interesting for testing structural properties of gauge theories. Detailed results on the superselection sectors'

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