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Equivalence between Non-localizable and Local Fields

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Abstract. We discuss the nature of non-localisable fields constructed as certain limits of sequences of local fields. For sequences for which the corresponding Wightman functions converge we construct a PCT operator; if the sequences converge strongly in a given Hilbert space then a scattering theory can be constructed for the non-localisable limit field. Such fields are shown to have the same S-operator as any local field which has the defining sequence of local fields in its Borchers class, and has the same in field. We give non-trivial examples of this equivalence between local and non-localisable fields.

1. Introduction

The problem of describing all relativistic quantum fields corresponding to a given S-matrix has not been yet solved. An important result in this direction was obtained by Borchers [1] in the frame of the (Wightman) axiomatic quantum field theory. According to this result of Borchers, fields are S-equivalent (i.e. correspond to the same S-matrix) if they are relatively local (or weakly relatively local). The relative locality (or the weak relative locality) is a relation of equivalence among quantum fields, so that all fields in a Borchers class (i.e. a class of relatively local or weak relatively local fields) are S-equivalent. The converse is not true: a Borchers class does not exhaust all fields with the same S-matrix (see for instance [2], p. 170) but we do not consider this problem here.

The S-equivalence of relativistic quantum fields was also studied in perturbation theory; we refer the reader to [3] and references quoted there for detailed results.

Roughly speaking the above results (in the axiomatic or in perturbation theory) are known to physicists in the following form: two fields, one of them being a *local function* of the other one, have the same S-matrix.