Commun. Math. Phys. 85, 73–86 (1982)

Communications in Mathematical Physics
© Springer-Verlag 1982

Local Aspects of Superselection Rules

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Abstract. We study a theory of short range forces in terms of local observable quantities; among the superselection structure determined by the algebra of all local observables, to each additive independent charge we associate local observables having a meaning analogous to the regularized integrals of charge density fields over a finite volume. Among other assumptions, we require that parastatistics are absent from the theories considered.

1. Introduction

The central role of the principle of locality in quantum field theory has long been stressed by Haag [1]. As formulated in [2] by this principle it is meaningful to consider (the algebra generated by) all the observables in a given theory that can be measured within a fixed bounded space-time region; moreover the correspondence so obtained

$$\mathcal{O} \to \mathfrak{A}(\mathcal{O}) \tag{1.1}$$

between regions and algebras of observables should contain all the physical information about the theory. In other words, the relevant specification on local observables is their spacetime localization and not their particular interpretation [1, 2].

This point of view proved to be extremely fruitful over the years, in analyzing matters of principles and the general structure of quantum field theory. In particular it has been possible to see how important features of a theory, that are usually described in terms of non-observable quantities like charged fields, are actually determined by the correspondence (1.1) alone.

We refer e.g. to the features of particle statistics and superselection structure. The superselection quantum numbers appear as labels of the equivalence classes of special irreducible representations of the algebra of all local observables, and are global data; they can be viewed as eigenvalues of "charge" operators Q, *a posteriori* determined by the algebra of quasilocal observables but not belonging

0010-3616/82/0085/0073/$02.80