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Local Aspects of Superselection Rules. II*

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Abstract. In a theory where the local observables are determined by local field algebras as the fixed points under a (*a priori* noncommutative) group of gauge transformations of the first kind, we show that, if the field algebras possess intermediate type I factors, we can construct observables having the meaning of local charge measurements, and local current algebras in the field algebras.

1. Introduction

In this paper we deal with the problem of proving, in a local quantum theory, the existence of observables associated to a given compact region in space-time which measure the superselection quantum numbers ("charges") contained in a smaller region. In [1] this problem was studied for a theory obeying two kinds of restrictions. Firstly, the charges should produce no long range correlations, i.e. the superselection structure should correspond to the "states of interest" of the theory studied in [2]. Second there should be no parastatistics; in addition to these, there were other restrictions made there, which however correspond to properties one would expect to hold in physically meaningful models.

In the discussion of [1], to which we refer for the motivations, the problem was formulated in terms of structural properties of the algebras of observable quantities alone. Here we remove the second type of restrictions, i.e. we deal with local quantum theories with a compact group of internal symmetry (the group of gauge transformations of the first kind) which is possibly nonabelian. This case differs from case [1] in two respects. First, in the presence of parastatistics, there is no theorem of existence and uniqueness of a field algebra obeying normal commutation relations associated to the net of local observables (see, however, [2, 3]). Second, the densities for the generators of the gauge transformations, which are the ultimate unknown of our problem, are not gauge invariant, i.e. cannot be observables. Therefore we limit ourselves to the case where the net of local algebras of field operators is given as the primary object.

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