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Field Operators for Anyons and Plektons

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Abstract. Given its superselection sectors with non-abelian braid group statistics, we extend the algebra $\mathscr{A}$ of local observables into an algebra $\mathscr{F}$ containing localized intertwiner fields which carry the superselection charges. The construction of the inner degrees of freedom, as well as the study of their transformation properties (quantum symmetry), are entirely in terms of the superselection structure of the observables. As a novel and characteristic feature for braid group statistics, Clebsch–Gordan and commutation "coefficients" generically take values in the algebra $\mathscr{M}$ of symmetry operators, much as it is the case with quasi-Hopf symmetry. $\mathscr{A}, \mathscr{F}$, and $\mathscr{M}$ are all C^* algebras, i.e. represented by bounded operators on a Hilbert space with positive metric.

1. Introduction and Results

It is very convenient and successful to describe quantum numbers of particles in terms of unobservable charged fields, which transform under a gauge group. This is motivated by the observation that non-trivial representations of the global gauge group give rise to superselection sectors for the gauge invariant quantities (observables), and is *a posteriori* justified by the result [1] of Doplicher and Roberts (referred to as the DR construction below), based on the theory of superselection sectors and statistics [2] of the same authors and Haag (DHR), that under reasonable assumptions in four space-time dimensions superselection sectors always arise by this mechanism, i.e. a gauge covariant field algebra can be constructed from the subalgebra of local observables and its superselection structure, such that its charged fields indeed generate the sectors. Essential for this construction is the fact that the superselection structure (i.e. multiplicities of irreducible subrepresentations π_γ in a product of sectors $\pi_\alpha \times \pi_\beta$) coincides with the unitary representation theory of some compact group G (i.e. multiplicities of $\mathscr{D}^\gamma$ within $\mathscr{D}^\alpha \otimes \mathscr{D}^\beta$).

Now, in recent analysis of conformal quantum field theory, models were discovered where this coincidence fails, and this failure has been traced back to a structural difference in the theory of superselection sectors for *low-dimensional* quantum physics in general. It may as well occur in $2+1$ dimensional theories with particle-like excitations carrying a "string of glue" with them. The new issue