

Comments on a Recent Solution to Wightman's Axioms

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Abstract: A class of exact Wightman functionals satisfying all fundamental physical requirements in an arbitrary number of space-time dimensions, which bear the appearance of describing interacting fields, was recently constructed by C. Read [1]. It is shown here, that the construction can be considerably generalized, and that even the enlarged class belongs to the Borchers class of a system of generalized free fields.

1. Introduction

Ever since Wightman's formulation of the axioms [2] to be satisfied by the collection of n -point functions of local quantum fields, there has been a discomfoting lack of models. Apart from models with polynomial interaction in two and three space-time dimensions, there are essentially only constructions based upon free fields and generalized free fields [3] available. These constructions involve Wick polynomials of derivatives of a given field, as well as so-called p - and s -products [4] (i.e., pointwise products resp. sums of independent fields in different Hilbert spaces). Although one can easily produce non-vanishing truncated Wightman functionals, such models do not describe interacting particles.

We recall the well-known list of axioms for a hermitian scalar field, referring to the standard literature [2] for the precise formulation: Positivity and Hermiticity permit to reconstruct a Hilbert space containing the cyclic vacuum vector, and an (in general unbounded) hermitian field $\phi(f)$ on this Hilbert space whose vacuum correlation functions are given by the Wightman functional. Poincaré Invariance of the Wightman functional ensures the invariance of the vacuum vector along with the Poincaré covariance of the reconstructed field. The Spectrum Condition and Cluster Property ensure the positivity of the energy spectrum