

Remarks on Conformal Invariance*

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Abstract. The existence of unitary representations for the special Conformal Group, is investigated for free fields in any dimension, and the connection between the correct transformation properties of the fields and weak conformal invariance pointed out.

I. Introduction

The use of conformal symmetry in quantum field theory has been advocated a decade ago by Wess [1] and Kastrup [2–4]. The renewed interest in this topic is closely connected to Wilson's [5] ideas on small distance behaviour of field operators and dynamical or anomalous dimensionality of fields. Moreover the Migdal-Polyakov construction [6–11] of conformal invariant quantum field theories offers an interesting alternative to canonical perturbation theory. It is hoped that these approaches reproduce correctly the behaviour of strong interacting systems in a particular class of high energy limits. This idea is supported by the fact that the Gell-Mann-Low limit [12, 13] of renormalizable theories is conformal invariant [14], when the coupling constant equals the Gell-Mann-Low eigenvalue.

On the other hand in “axiomatic” quantum field theory “proper conformal invariance” meets a serious difficulty, which originates from the fact, that conformal transformations can convert time – like into space – like separations and vice versa. This may spoil the fundamental concept of locality or Einstein causality. Thus it appears questionable that conformal symmetry (apart from certain limiting cases) should hold in general quantum field theory. Indeed Hortaçsu, Schroer and Seiler [15] have shown that due to the reverberation phenomenon of free fields in odd space – time dimension (i.e. the commutator is not concentrated on the light cone but spreads out into the time like region) the usual or

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