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REMARKS ON THE GREEN FUNCTIONS OF EXPONENTIALS OF FREE FIELDS

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Let

$$B(x) = :e^{ifA(x)}: -1$$

where A is a free scalar or pseudoscalar field. The problem of defining time-ordered Green functions of the B-field has been treated repeatedly in the literature [1], in recent years in particular by Volkov [2]. We have re-examined some aspects of this problem and, since Volkov is not present at this meeting, give a brief summary of results on the two-point function. We add some vague remarks on n-point functions which, in our opinion, are little understood at present.

Simple examples of Lagrangian models where exponentials of free fields occur are the derivative coupling of the scalar field to a spinor field (which has a trivial scattering matrix) and ps(pv) coupling of a spinor field to a neutral pseudoscalar field [1), 2)].

A mathematical basis for treating a certain class of entire functions of free fields which includes the operator B has been given by Jaffe [3]. The unordered products

$$\langle 0|\, B(x)\, B(y)\,|0\rangle \qquad \text{and} \qquad \langle 0|\, B(x)\, B^{+}(y)\,|0\rangle$$

are well-defined generalized functions. The corresponding time-ordered products require discussion along lines indicated by Jaffe [3] and contain arbitrary parameters. In the case of the BB product uniqueness is achieved by demanding that the propagator in momentum space vanishes for large space-like momenta. The BB^{+} product is more singular and uniqueness follows only from the requirement that the real part of the

propagator for time-like momentum vanishes asymptotically, a condition which is not clearly motivated.

For the definition of general Green functions, it is necessary to consider products of propagators. Volkov [2] has given a recipe for this and it appears possible to view this construction as an analytic regularization related to the work of Speer [4]. The question whether the Green functions so defined satisfy the conditions of unitarity and locality requires, in our opinion, further investigation. Also, as emphasised by Zumino in his talk, the non-uniqueness problem is not at all understood.

REFERENCES

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