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Nonlinear Realization of Chiral Symmetries and Localizability*

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Abstract. We prove that the nonlinear realization of $SU(n) \times SU(n)$ $(n \geqq 3)$ is uniquely determined by the requirement that the Lagrangian, with a minimal number of derivatives of those fields parametrizing the adjoint representation of the diagonal $SU(n)$ subgroup, is localizable in the sense of Jaffe.

I. Introduction

In this paper we generalize a theorem due to Lehmann and Trute [1] which states that the nonlinear realization of the chiral $SU(2) \times SU(2)$ symmetry is uniquely determined by the requirement of localizability. We extend this theorem to $SU(n) \times SU(n)$ $(n \geqq 2)$.

Each realization on a manifold of fields of the chiral group $SU(n) \times SU(n)$, which becomes linear if restricted to the diagonal $SU(n)$ subgroup, can be brought by a suitable change of coordinates on the manifold into a "standard form" (Coleman, Wess, and Zumino [2]):

$$\begin{gathered} g : \xi \to \xi', \ \boldsymbol{\Psi} \to \boldsymbol{\Psi}' = \mathscr{D}(e^{\boldsymbol{U}' \boldsymbol{V}}) \boldsymbol{\Psi} \\ g \in SU(n) \times SU(n) \end{gathered} \tag{1}$$

$\mathscr{D}$ is a linear representation of $SU(n)$.

$$g e^{\xi \cdot \boldsymbol{A}} = e^{\xi' \cdot \boldsymbol{A}} e^{\boldsymbol{U}' \cdot \boldsymbol{V}},$$

$$\boldsymbol{A} = (A_1 \ldots A_{n^2-1}), \qquad \boldsymbol{V} = (V_1 \ldots V_{n^2-1}).$$

With V_i we denote the vectorial and with A_i the axial generators of $SU(n) \times SU(n)$. We choose the V_i and A_i so that they are orthonormal with respect to the Killing form. Each element g_0 in a neighbourhood of the identity of $SU(n) \times SU(n)$ can be uniquely decomposed into a product of the form:

$$g_0 = e^{\xi_0 \cdot \boldsymbol{A}} e^{\boldsymbol{U}_0 \cdot \boldsymbol{V}}.$$

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