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THE CONCEPT OF THE PRASPINOR

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The concept of the praspinor would seem too abstract if it did not suggest itself from various standpoints in nonlinear field theory, the theory of compensating fields, new symmetries, vacuum theory, as well as the basic nature of spinor manifolds that uniformly describe internal, dynamic, and spatial properties of particles. Thus, leptons, colored hadrons, and "charming" quarks, relativistic fermions, as well as the affine and conformal structure of spacetime are characterized by equivalent four-spinor representations of the algebra sL(4, C), which may be considered as a universal algebra of symmetries. The concept of the praspinor, which has resulted from studies by Wheeler, Weizacker, and Penrose and the basic nature of the binary code in cybernetics and logic and studies by Finkerlstein and Snider [1] reflect a general objective trend in which the interrelation between a field, matter, a vacuum, space, gravitation, and cosmology has taken the foreground; this can no longer be ignored and none of these six forms of physical reality can be understood without determining how they each interrelate. The most important element in the analysis of the concept of the praspinor is the polystructural nature of objects of the microcosm, which occurs both in the indeterminacy principle and in corpuscular-wave dualism and, for example, in the absence of any correlation between the quark and parton structures of the hadron arising in different types of scattering. According to this representation, a quantum object is characterized by a complex of incommensurate structures and one such structure is isolated in each experiment, i.e., the object is decomposed into a corresponding pure ensemble which becomes its basis (for example, depending on the problem, particles can be described by different spatial states related to each other as subspaces). From these standpoints, praspinor theory models only the algebraic structure of particles, a vacuum, etc., whose simplest element it is and no definite space-field object necessarily corresponds to it. Nonlinearity is the only property of the praspinor, which is also supposed to determine its basic nature (the entire algebraic structure is reproduced on the basis of this nonlinearity), and this makes it possible to apply the theory of compensating fields [2, 3] to the praspinor.

From the point of view of compensation theory, nonlinearity is the manifestation of the self-action of a system whose evolution and automorphisms characterizing it are described by morphisms of a layer of stratified space as it moves along the base and are specified by the connectivities in the layer (compensating fields), which are precisely the interaction potentials or, in other words, describe particles transporting the interaction. Let us consider a pure vector stratification of type Q with base Y, in which Q represents an algebra E that is a Cartan subalgebra of the algebra $K=(E, F)$. We will let Y be the space F of parameters and define it over some open neighborhood Y_U of the zero of a system of exterior differential forms h^a in the tangent stratification to Y and the exterior differentiation operator d. We define the form $\omega=e^{-y^a I_a}(d-\Delta)e^{y^a I_a}$, where y^a is the tangent stratification cross section by Y_U; Δ is a one-form, such that $I_m(\Delta)=dI_m-[I_m, \Delta]$; I_a are the generators of F, and we assume that the operators $e^{y^a I_a}$ are defined in Y_U [2], $\omega=\omega_E^n I_n+\omega_F^m I_m$. We set $\omega_F^m=0$ in the sense of the Higgs inverse effect and the covariant differential is written $D=d+\omega_F^m I_m$, which is the well-known formalism of Goldstone theory. However, we may write ω_E^m in the form $\omega_E^m=-H^m-Mh^a\Omega_a^m I_m$, where H^m is determined by the condition $(d-H)h^a\equiv 0$, thereby establishing a relation between the goldstones y^a and the compensating fields Ω_a^m, which is preferable to the usual fields as it provides a clearer physical interpretation.

Let us now apply this formalism to a self-acting praspinor, taking the algebra SU(2) as E and its extensions (three types) by the spinor translations P_Ψ as K. In the simplest case Ψ is a two-component spinor of the representation $\square$ (in Young diagrams) of SU(2) and the compensating fields Ω_Ψ^m[m are the indices of SU(2)] be-

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long to the reducible representation* $\square \otimes \square\square$ containing the irreducible component $\square$, i.e., the fields are two-spinors with respect to SU(2). In the second case K is the algebra SU(3) [Su(2, 1)] and the operators P_Ψ and $\lambda_4 \pm i\lambda_5$ and $\lambda_6 \pm i\lambda_7$ correspond to the translations P_Ψ; Ψ is a four-spinor that nonlinearly represents SU(3). The compensating fields obtained in this case are four-spinor representations $\square$ with respect to SU(4) [SU(2, 2)]. In the third case, as in the second case, Ψ is a four-spinor but SU(2) operates over only two of the components of Ψ, while k can be a Lie algebra. The compensating fields form a representation $\begin{smallmatrix}\square & \square \\ \square & \end{smallmatrix}$ with respect to SU(4) that can be partitioned into three octets corresponding to the three independent ("chromatic") subalgebras SU(3) of SU(4).

The SU(2) symmetry can be considered internal. On the other hand, dynamic symmetries arise if we assume that the frames in which the different praspinors are being considered are not synchronized. Therefore, each spinor will be equipped with its own frame that can be characterized by some operator $\hat{O} \in SU(2)$, and will be specified by the pair $(\Psi, \hat{O})$ or (Ψ, Ψ'). The introduction of a multitude of internal frames is essentially implicit in the introduction of the exterior space at whose points the praspinors are defined and Ψ' can be considered as dynamic indices while the $\{\hat{O}\}$ relate the dynamic and internal symmetries. We will assume that the $\hat{O}$ are arbitrary and that the two algebras SU(2) and SU(2') of the internal and dynamic symmetries, acting correspondingly over Ψ and Ψ' are independent. Compensation of SU(2)' is performed as for SU(2), though the compensating fields should be bounded by the two-spinors of SU(2) or the four-spinors† of SU(2, 2). The external space Y in this case is provided by the four-spinor structure of SU(2, 2) (conformal algebra), which, following Penrose, can be related to the pseudo-Euclidean structure of Y, characterizing it as spacetime and intrinsic to macroscopic systems, in which the growth in entropy distinguishes in Y the direction of irreversible evolution (time) and a system of motions orthogonal to it (space).

It follows from the above that compensating fields coincide in algebraic structure with the lepton quartet and the baryon octet, if we jointly consider the internal and dynamic symmetries of the praspinor that can be described by the algebra $E^- = \{ I_{mM} = I_m I_M,\ I_m \in SU(2)',\ I_M \in SU(2),\ I_{mM} \circ I_{nN} = C^k_{mn} C^k_{MN} I_{kK} \}$.‡ Thereby, if we also assume that praspinors describe the algebraic structure of a vacuum, leptons and baryons, like phonons in solids, can be graphically represented as disturbances of the vacuum, or, in other words, as potentials of the SU(2)-interaction between the praspinors, but with greater energy density in the zone of the disturbance, which will lead to a substantial variation of their spatial structure, i.e., on the whole, reduce them to particles.

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* $\square \otimes \square\square = \square\square\square + \square$, but we will assume that no completely symmetrized representation is realized [2].

†The compensating fields are finally determined from field theory, for example, from the field equations, though field theory in the case of spinor manifolds breaks down. Therefore, supersymmetries are usually assumed in order to obtain spinor compensating fields, while Y is assumed to be a spin-coordinate manifold, which makes it possible to construct Lagrangian theory.

‡In this formulation of compensation theory the compensating fields may have mass.