CLASSIC STATES OF GOLDSTONE AND PSEUDO-GOLDSTONE FIELDS

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A class of solutions of the equations of motion has been found for the pion field described by the chiral Lagrangian [1]. Though there is a strong interaction of pions, these solutions have a plane-wave character, under the condition that there are certain relations between the amplitudes and phases of the different isotopic components. It has been suggested that the solutions might describe the pion production in collisions of high energy heavy ions. This means the creation of the fragments of classical pion field, i.e. a coherent state with an indefinite number of particles. One of the characteristic features of this picture is a strong violation of the isotopic invariance in single collisions: the numbers of the charged and neutral pions could differ essentially. Some other consequences of the model are considered in ref. [2]. In the paper by A.P.Bukhvostov and L.N. Lipatov [3] it has been shown that the solutions mentioned above can be generalized to a class of "covariantly homogeneous" solutions which exist in nonlinear σ-models.

Another interesting class of solutions exists for a pseudo-Goldstone field with the selfinteraction of the type $V \sim \cos \Phi$. There can be found the stable, stationary periodic solutions which are stable to the variations of the field [4,5]. The stability has a topological nature: is due to the existence of a certain winding number.

These solutions have been applied for description of the possible large-scale periodic structure of the Universe [6]. The structure could be explained by the existence of the classical field with a periodic distribution of energy in radial coordinate. The galaxies can cluster near the maxima of the energy density of the classical field due to gravitational coupling.

References

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