About the paper
METASTABLE STATES OF 2-DIMENSIONAL ISOTROPIC FERROMAGNETS
A.A. Belavin, A.M. Polyakov
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A.A. Belavin

L.D. Landau Institute for Theoretical Physics,
142432 Chernogolovka, Russia

In Alexander Polyakov's and mine paper "Metastable States of 2-Dimensional Isotropic Ferromagnets" [1], we have found metastable states of Heisenberg's ferromagnet. Such states now are called "instatons".

The main reason for our search and discovery of such states was a hypothesis that such states would create an infinite correlation length at very low temperatures, obstructing spontaneous symmetry breaking. Later, this hypothesis was proven by calculation of partition function in the model using saddle-point method, taking instantons into account.

Actually, there was another reason for the search. The fact is that quantum theory of the field, which describes Heisenberg's 2-dimensional ferromagnet, is in many ways similar to the Yang-Mills theory. In the beginning of 1960s, Gell-Mann has suggested that all elementary particles are made out of quarks. Since the beginning of 1970s, theoretical physicists have begun to assume that theory, which describes quark interaction, is Yang-Mills theory.

Experiments that were trying to study proton's structure have confirmed presence of quarks in them, but on the other hand, separately, quarks are not observed. This paradox is called color confinement. As G. 't Hooft has shown [2], quarks will not fly out, if Yang-Mills theory has no spontaneous breaking of local calibration symmetry. In turn, an obstacle for such a breaking would be metastable states, instatons, if they appear in Yang-Mills theory.

Such states were later found in our work with Polyakov, Schwartz and Tyupkin [3].

References

[1] A.A. Belavin, A.M. Polyakov , JETP Letters 22, 245, (1975)

[2] G. 't Hooft Nuclear Physics B 33, 173 (1971).

[3] A.A. Belavin, A.M. Polyakov, A.S. Schwartz, Yu.S. Tyupkin ,Phys.Lett. 59 B ,85 (1975)