Between Order and Disorder in Yang-Mills System

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Abstract

The Yang-Mills systems are governed by nonlinear equations and so it is not a surprise if they have a chaotic behavior. But on the other hand, there are many examples of stable solutions of nonlinear field equations. So the question of order and disorder in the equations of Yang-Mills systems is not a trivial one. In the contest of particle physics, Matinyan and al, were the first to show that classical Yang-Mills system is a K-one. It has been conjectured by Nikolaevsky and Shchur that if chaos is present in the dynamics of homogeneous field, then it is present in the full field theory. This was confirmed in the Y-M field. In this work we consider a little bit complication: we add quantum to the previous study. We found that the quantum version of a Yang-Mills gauge theory returns to the classical case if one neglects the interference terms and thus it is writing as a system of two non-linear differential equations. We study this quantum version by using the Painlevé test to demonstrate that the theory is non-integrable and also with the use of the graphical procedure to make evident the sensitivity of the theory to initial conditions. Then we modelize the interference parts with a white noise term and transform the system to a couple of stochastic differential equations and study them using the Khasminski procedure. We find that our stochastic differential system has a unique solution that does not explode in a finite time.

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