Gross-Neveu Models, Nonlinear Dirac Equations, Surfaces and Strings

http://www.firstlight.cn 2010-11-30

Recent studies of the thermodynamic phase diagrams of the Gross-Neveu model (GN2), and its chiral cousin, the NJL2 model, have s hown that there are phases with inhomogeneous crystalline condensates. These (static) condensates can be found analytically because the rel evant Hartree-Fock and gap equations can be reduced to the nonlinear Schr\"odinger equation, whose deformations are governed by the mKd V and AKNS integrable hierarchies, respectively. Recently, Thies et al have shown that time-dependent Hartree-Fock solutions describing bar yon scattering in the massless GN2 model satisfy the Sinh-Gordon equation, and can be mapped directly to classical string solutions in AdS 3. Here we propose a geometric perspective for this result, based on the generalized Weierstrass spinor representation for the embedding of 2 d surfaces into 3d spaces, which explains why these well-known integrable systems underlie these various Gross-Neveu gap equations, an d why there should be a connection to classical string theory solutions. This geometric viewpoint may be useful for higher dimensional mode ls, where the relevant integrable hierarchies include the Davey-Stewartson and Novikov-Veselov systems.

存档文本