
SEMINAR FIZIČKOG ODSJEKA

Vrijeme: četvrtak, 27. 09. 2007., 14:15 sati (točno)
Mjesto: Fizički odsjek, Bijenička c. 32, predavaonica F102

Stable Fermion Bag Solitons in the Massive Gross-Neveu Model: Inverse Scattering Analysis

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Formation of fermion bag solitons is an important paradigm in the theory of hadron structure. We study this phenomenon non-perturbatively in the 1+1 dimensional Massive Gross-Neveu model, in the large N limit. We find, applying inverse scattering techniques, that the extremal static bag configurations are reflectionless, as in the massless Gross-Neveu model. This adds to existing results of variational calculations, which used reflectionless bag profiles as trial configurations. Only reflectionless trial configurations which support a single pair of charge-conjugate bound states of the associated Dirac equation were used in those calculations, whereas the results in the present paper hold for bag configurations which support an arbitrary number of such pairs. We compute the masses of these multi-bound state solitons, and prove that only bag configurations which bear a single pair of bound states are stable. Each one of these configurations gives rise to an O(2N) antisymmetric tensor multiplet of soliton states, as in the massless Gross-Neveu model.

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