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SEMINAR ZAVODA ZA TEORIJSKU FIZIKU

(Zajednički seminari Zavoda za teorijsku fiziku,
Zavoda za eksperimentalnu fiziku i Zavoda za teorijsku fiziku PMF-a)

Quantized Normal Matrices: Some Exact Results and Collective Field Formulation

Prof. Dr. Joshua Feinberg
Department of Physics, Oranim University of Haifa and
Department of Physics, Technion,
Haifa, Israel

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Abstract:

We formulate and study a class of U(N)-invariant quantum mechanical models of large normal matrices with arbitrary rotation-invariant matrix potentials. We concentrate on the U(N) singlet sector of these models. In the particular case of quadratic matrix potential, the singlet sector can be mapped by a similarity transformation onto the two-dimensional Calogero-Marchioro-Sutherland model at specific couplings. For this quadratic case we were able to solve the $N-$body Schrödinger equation and obtain infinite sets of singlet eigenstates of the matrix model with given total angular momentum. Our main object in this talk is to present the singlet sector in the collective field formalism, in the large-N limit. We obtain in this framework the ground state eigenvalue distribution and ground state energy for an arbitrary potential, and outline briefly the way to compute bona-fide quantum phase transitions in this class of models. As explicit examples, we analyze the models with quadratic and quartic potentials. In the quartic case, we also touch upon the disk-annulus quantum phase transition. In order to make our presentation self-contained, we also discuss, in a manner which is somewhat complementary to standard expositions, the theory of point canonical transformations in quantum mechanics for systems whose configuration space is endowed with non-euclidean metric, which is the basis for constructing the collective field theory.

Voditeljica seminara:

Dr. Blaženka Melić
⟨*melic@thphys.irb.hr*⟩