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Invited Talk - Quantum phase transitions in matrix model of two-color QCD - Nirmalendu Acharya, IIT Bhubaneswar

Sunday 24 August 2025 12:00 (1 hour)

$SU(2)$ gauge theory coupled to fundamental or adjoint quarks (two-color QCD) has been the subject of considerable interest and investigation. It has several novel and intriguing
features which are worth studying in their own right. Here, we consider the matrix model of two-color QCD: a quantum mechanical model on $S^3 \times \mathbb{R}$ coupled to N_f fermions (which transform in fundamental or adjoint representation of the gauge group). In this model, we use the variational methods to construct the energy eigenstates with $N_f = 1$ and $N_f = 2$ (in both the weak and the strong coupling regimes). We study the properties of the ground state in the chiral limit and in the heavy fermion limit. Further, we explore situations with large baryon number and isospin chemical potentials. We find that there exists a rich quantum phase transition (QPT) structure in these models and different phases are characterized by different ground states. In the extreme strong coupling regime, we find that the dominant glue contribution to the ground state comes from reducible connections. On the other hand, when the chemical potentials are present, the ground state can have non-zero spin. In such a scenario, the ground state breaks the rotational invariance and this is a reminiscence of the LOFF phases observed in two-color QCD. We estimate the division of the total spin of the ground state between the glue and the quark: the glue contribution is significant, particularly in the strong coupling regime and chiral limit.

Session Chair : Nirmalya Kajuri