Contribution ID: **121** Type: **Talk**

Towards an Effective String Theory for the flux-tube

Wednesday, 31 July 2024 11:35 (20 minutes)

The quest to develop an effective string theory capable of describing the confining flux-tube has been a long-standing objective within the theoretical physics community. Recent lattice results indicate that the low-lying spectrum of the flux-tube in both three and four dimensions can be partially described by the Nambu-Goto string with minor deviations. However, several excitation states exhibit significant corrections that have remained unexplained until recently.

Recent advancements suggest that a Thermodynamic Bethe Ansatz analysis, expanded in both $1/R\sqrt{\sigma}$ and the softness of phonons, can lead to a robust effective string theory for the flux-tube with length R. Furthermore, lattice data points to the existence of an axion field on the world-sheet of the flux-tube, implying that an Axionic String Ansatz should accompany the Nambu-Goto framework.

In our presentation, we will provide compelling evidence that this approach can closely approximate the flux-tube data. We will demonstrate this by comparing results obtained for the spectrum of the $SU(N)$ closed flux-tube using lattice techniques in four dimensions.

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Session Classification: Vacuum structure and confinement

Track Classification: Vacuum Structure and Confinement