Abstract

In this thesis, we focus on two crucial aspects of holography, first, the appearance of classical integrability in the low energy decoupled versions of brane geometries with Anti de-Sitter (AdS) factors and second, aspects of some D-brane phenomenology in QCD-like non-supersymmetric nonconformal gauge theories which are realized on the worldvolume of the non-supersymmetric D-branes.

In the first part of the thesis, we prescribe an elegant manifestation of deformed Neumann-Rosochatius (NR) model, one of the earliest classical one dimensional integrable models, for rotating and pulsating ansatz for some chosen probes in different AdS backgrounds stemmed from some well-known brane configurations. By solving the integrable equations of motion of the NR model, we reproduced, at least up to some special limits, the energy-momenta relations of some generic string states that are dual to some known local gauge-invariant operators as well as to the relevant spin chain descriptions.

In the line of phenomenological exploration, we take both isotropic as well as anisotropic non-BPS D2 brane sectors of type IIB supergravity and observe the QCD-like confinement and pseudoscalar glueball mass spectrum of the respective worldvolume gauge theories in the entire non-perturbative region. We find different QCD features consistent with those so far obtained in higher dimensional pure Yang-Mills theories. In particular, for the anisotropic D2-brane case, our nonperturbative knowledge articulates the Hawking-Page transition by controlling the anisotropy and infers the QCD confinement-deconfinement transition as its dual from an tangible finite temperature scenario.

Keywords: AdS/CFT correspondence, Semiclassical string, Non-susy brane, String/QCD duality, Running coupling, Confinement, QCD string tension, Pseudoscalar glueball mass, QCD3, Hawking-Page Transition