Contribution ID: **25** Type: **not specified**

An overview of light-front holography

Thursday, September 19, 2019 10:00 AM (30 minutes)

Light-front holography refers to an exact correspondance between semiclassical (with zero quark masses and no quantum loops) light-front QCD and a gravitational theory in 5-dimensional anti-de Sitter spacetime. Conformal symmetry is broken in a novel way, namely by the so-called dAFF (de Alfaro, Furbini and Furlan) mechanism which allows the emergence of a fundamental AdS/QCD mass scale κ in the Hamiltonian while retaining the conformal invariance of the action. The AdS/QCD scale κ sets the confinement scale as well as the mass scale for hadron spectroscopy in physical spacetime. Remarkably, the pion remains massless in the presence of a non-zero κ just as expected in QCD for massless quarks. Superconformal algebra allows a unified description of mesons, baryons and tetraquarks spectroscopy. The AdS/QCD scale κ is perhaps more fundamental than the familiar Λ_{QCD} scale which emerges due to dimensional transmutation in perturbative QCD. In fact, by matching of the κ-dependent running strong coupling in the infrared to the Λ_{QCD}-dependent running strong coupling in perturbative QCD, the latter scale can be predicted from the former. Light-front holography serves as an excellent first approximation to hadron physics. Going beyond the semiclassical approximation, quark masses and their spins can be taken into account *a posteriori*, leading to successful unified description of observables involving light pseudoscalar and vector mesons using a single universal value of the AdS/QCD scale κ. Light-front holographic wavefunctions also serve as basis functions for Basis Light-Front Quantization which is a promising method for investigating non-perturbative QCD.

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Session Classification: Plenary

Track Classification: Phenomenological models