



Theory Seminar

Monday, February 18, 2008 2:10 PM 831 Pupin Hall

The AdS/CFT Correspondence and Light-Front QCD

The AdS/CFT correspondence between string theory in AdS space and conformal field theories in physical space-time leads to an analytic, semi-classical model for strongly-coupled QCD which has scale invariance and dimensional counting at short distances and color confinement at large distances. Although QCD is not conformally invariant, one can nevertheless use the mathematical representation of the conformal group in five-dimensional anti-de Sitter space to construct an analytic approximation to the theory. The AdS/CFT correspondence also provides a mapping between the fifth-dimensional coordinate of AdS space and a specific impact variable which measures the separation of the quark and gluonic constituents within the hadron. This connection allows one to compute the analytic form of the frame-independent light-front wavefunctions of mesons and baryons, the fundamental entities which encode hadron properties and which allow the computation of exclusive scattering amplitudes. A new integrable relativistic light-front equation in ordinary space-time is found which reproduces the results obtained using the fifth-dimensional theory. An extension for massive quarks will also be discussed. Since they are complete and orthonormal, the AdS/CFT wavefunctions can also be used as a basis for the diagonalization of the full light-front QCD Hamiltonian, thus systematically improving the AdS/CFT approximation.

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