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### **The AdS/CFT Correspondence and QCD Phenomenology<sup>1</sup>**

STANLEY J. BRODSKY, Stanford Linear Accelerator Center, Stanford University

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 a first approximation to the theory. The AdS/CFT correspondence also provides insights into the inherently non-perturbative aspects of QCD such as the orbital and radial spectra of hadrons and the form of hadronic wavefunctions. In particular, de Teramond and I have shown that there is an exact correspondence 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 in ordinary space-time. 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 relativistic light-front equation in ordinary space-time is found which reproduces the results obtained using the five-dimensional theory. Since they are complete and orthonormal, the AdS/CFT model 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. A number of applications of light-front wavefunctions to QCD phenomenology are discussed such as form factors, color transparency, hidden color, intrinsic charm, and spin dynamics.

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