Contribution ID: **1** Type: **Invited talk**

Simple Light Front Quark Models

Wednesday 1 December 2021 09:00 (30 minutes)

I discuss a relativistic light-front model of hadrons based on strong-coupling QCD degrees of freedom that is designed to be simple enough to explore the role of sea quarks in hadronic structure and reaction calculations. The degrees of freedom are confined local and global color singlet systems quarks of antiquarks connected by "strings" represented by confining interactions. These bare singlets interact via a string breaking interaction. The bare singlets have an approximate linear confinement and lie on Regge trajectories. The string breaking interaction makes most of the bare singlets unstable. Like QCD, the scales of the model are set by the quark masses and a single strength parameter. The strings break with approximately equal probability at any point along the line connecting quarks and antiquarks or diquarks. In this model the flavor dependence only enters via the quark masses. The model has several interesting features. First it has dual representations in terms of partonic and hadronic degrees of freedom. The relativistic invariance is exact; including transverse rotations. The wave functions for all bare hadrons can be evaluated analytically and hadronic matrix elements of the string breaking vertex for any combination of initial and final bare hadronic states can also be evaluated analytically. Using the Regge slope of the bare mesons to fix the single strength parameter in the meson sector results in a bare mass spectrum, pi-pi scattering cross section and rho lifetime, and pion form factor that are approximately consistent with experiment. The strength parameter used in the meson sector also gives a consistent picture of the bare mass splittings in the baryon sector. Prediction for sea quark probabilities were investigated for both the pion and proton. The model can also be applied to treat exotic mesons and baryons singlet systems of quarks and diquarks.

This work supported by the U.S. Department of Energy,
Office of Science, Grant \#DE-SC16457

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Session Classification: Plenary Session