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Hadron Physics from Superconformal Quantum Mechanics in the Light-Front and its Holographic Embedding

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Relativistic bound-state equations for mesons and baryons are constructed in a semiclassical approximation to light-front QCD from a superconformal algebra which relates baryon and meson spectra. This procedure uniquely determines the confinement potential for arbitrary spin and its embedding in AdS space. The specific breaking of dilatation invariance within the supersymmetric algebra explains hadronic properties common to light mesons and baryons, such as the observed mass pattern in the radial and orbital excitations, as well as their distinctive and systematic features. The lowest-lying state, the the pi-meson, is massless in the chiral limit and has no supersymmetric partner. Quark masses break conformal invariance, but the basic underlying supersymmetric mechanism gives remarkable connections across the entire spectrum of light and heavy-light hadrons. We also explore the consequences of extending supersymmetry to double-heavy mesons and baryons.

Primary author: Prof. DE TERAMOND, Guy (University of Costa Rica)

Co-authors: Prof. DOSCH, Hans Guenter (University of Heidelberg, ITP); Prof. BRODSKY, Stanley (SLAC)

Presenter: Prof. DE TERAMOND, Guy (University of Costa Rica)

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