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Heavy-light diquark masses from QCD sum rules and constituent diquark models of charmonium-like tetraquark states

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The X(3872) was discovered in 2003 by the Belle collaboration, and was subsequently confirmed by the CDF, D0, Babar and LHCb collaborations. This hadron lies within the mass range of the well-established charmonium mesons, but it is difficult to interpret as a charmonium state. In addition to the X(3872), several other hadrons have been discovered that are difficult to interpret as charmonium states. These hadrons are collectively referred to as charmonium-like or XYZ states. There has been much speculation that at least some of the XYZ states could be exotic hadrons, such as four-quark states, which can be realized in two distinct ways: loosely bound mesonic molecules and tetraquarks, which are tightly bound diquark anti-diquark bound states. Diquarks are two-quark clusters that are thought to exist within hadrons. Many XYZ states have been interpreted as tetraquarks using the constituent diquark model, where the constituent diquark mass is an input parameter extracted from fits to tetraquark candidates. QCD sum rules is an analytical method that can be used to calculate hadronic parameters, such as the constituent diquark mass, and thus can be used to provide a QCD-based test of the constituent diquark model of tetraquark candidates among the XYZ states. In this talk I will provide a brief overview of the XYZ states, exotic hadrons and QCD sum rules. I will also discuss some of our recent work using QCD sum rules to test the constituent diquark model of XYZ states. This work could help to discern between the mesonic molecule and tetraquark scenarios of four-quark states, contributing to efforts to understand the enigmatic XYZ states.

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