

Lattice QCD Studies of Glueballs

Friday, 9 October 2026 10:30 (30)

Glueballs provide a direct setting for studying how nonperturbative gauge dynamics generates massive hadronic excitations. While lattice calculations in pure Yang–Mills theory have established a well-defined glueball spectrum, identifying the corresponding states in full QCD is considerably more challenging. In the scalar channel, gluonic, quark–antiquark, and multihadron operators couple to the same finite-volume eigenstates, so mixing and strong-decay effects must be treated explicitly.

In this talk, I will briefly review lattice-QCD studies of the glueball spectrum and radiative processes relevant to experimental searches. I will then present our recent study of scalar glueball– $(s\bar{s})$ mixing in $(N_f=1)$ lattice QCD with a dynamical strange quark, where we find sizable mixing between the gluonic and $(s\bar{s})$ sectors. Finally, I will discuss our ongoing extension toward a larger variational basis including flavor-singlet two-meson operators, with the longer-term goal of studying scalar scattering and resonance properties.

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Session Classification : Section 2