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Flavor-singlet meson and glueball mixing in lattice QCD

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A careful study of the low-lying flavor-singlet meson spectrum using lattice QCD can help to better understand the nature of the current glueball candidates. We use light meson, charmonium, glueball and two-pion operators to map this spectrum and quantify the mixing between the different states. We increase the overlap with physical states by using highly improved mesonic and gluonic operators, which allows us to extract the spectrum and mixing overlaps between the states of interest and those created by the operators. These overlaps are useful to understand the nature of the states. The study is done in $N_f = 3 + 1$ QCD with pion masses $m_\pi \approx 800, 420$ MeV, where the pion mass tuning is particularly useful to control possible decay channels of the scalar glueball.

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