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Large scale separation and hadronic resonances from a new strongly interacting sector

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Many theories describing physics beyond the Standard Model rely on a large separation of scales. Large scale separation arises in models with mass-split flavors if the system is conformal in the ultraviolet but chirally broken in the infrared. Because of the conformal fixed point, these systems exhibit hyperscaling and a highly constrained resonance spectrum. We derive hyperscaling relations and investigate the realization of one such system with four light and eight heavy flavors. Our numerical simulations confirm that both light-light and heavy-heavy resonance masses show hyperscaling and depend only on the ratio of the light and heavy flavor masses. The heavy-heavy spectrum is qualitatively different from QCD and exhibits quarkonia with masses not proportional to the constituent quark mass. These resonances are only a few times heavier than the light-light ones, which would put them within reach of the LHC.

Experimental Collaboration

Primary author: WITZEL, Oliver (University of Edinburgh)

Co-authors: Prof. HASENFRATZ, Anna (University of Colorado, Boulder); Prof. REBBI, Claudio (Boston University)

Presenter: WITZEL, Oliver (University of Edinburgh)

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