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Large mass hierarchies from strongly-coupled dynamics

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Motivated by tentative signals of new physics at the LHC, which seems to imply the presence of large mass hierarchies, we investigate the theoretical possibility that these could arise dynamically in new strongly-coupled gauge theories extending the standard model of particle physics. To this purpose, we study lattice data on non-Abelian gauge theories in the (near-)conformal regime—specifically, $SU(2)$ with $N_f = 1$ and 2 dynamical fermion flavours in the adjoint representation. We focus our attention on the ratio R between the masses of the lightest spin-2 and spin-0 resonances, and draw comparisons with a simple toy model in the context of gauge/gravity dualities. For models in which large anomalous dimensions arise dynamically, we show indications that this mass ratio can be large, with $R > 5$. Moreover, our results suggest that R might be related to universal properties of the IR fixed point. Our findings provide an interesting step towards understanding large mass ratios in the non-perturbative regime of quantum field theories with (near) IR conformal behaviour.

Primary authors: Dr ATHENODOROU, Andreas (University of Cyprus); Prof. LUCINI, Biagio (Swansea University); Dr ELANDER, Daniel (University of the Witwatersrand); Dr BENNETT, Ed (Swansea University); Dr BERGNER, Georg (AEC ITP University of Bern); Prof. C.-J. DAVID, Lin (National Chiao-Tung University); Prof. PIAI, Maurizio (Swansea University)

Presenter: Dr BENNETT, Ed (Swansea University)

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