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Theory Synergies: Observable effects of quark dressing in hadron physics[1]

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With discovery of the Higgs boson, the Standard Model of Particle Physics became complete. Its formulation and verification are a remarkable story. However, the most important chapter is the least understood. Quantum Chromodynamics (QCD) is that part of the Standard Model which is supposed to describe all of nuclear physics and yet, almost fifty years after the discovery of quarks, we are only just beginning to understand how QCD builds the basic bricks for nuclei: pions, neutrons, protons. QCD is characterised by two emergent phenomena: confinement and dynamical chiral symmetry breaking (DCSB), whose implications are truly extraordinary. This presentation will reveal how DCSB, not the Higgs boson, generates more than 98% of the visible mass in the Universe, explain why confinement guarantees that condensates, those quantities that were commonly viewed as constant mass-scales that fill all spacetime, are instead wholly contained within hadrons; and elucidate a range of observable consequences of these phenomena whose measurement is the focus of a vast international experimental programme.

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