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Physics Beyond the Standard Model, search for non-perturbative models of electroweak symmetry breaking

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The Standard Model provides an elegant mechanism for electroweak symmetry breaking (EWSB) via the introduction of a scalar Higgs field. However, the Standard Model Higgs mechanism is not the only way to explain EWSB. A class of models, broadly known as Technicolor, postulates the existence of a new strongly-interacting gauge sector at the TeV scale, coupled to the Standard Model through technifermions charged under electroweak. In technicolor, the spontaneous breaking of chiral symmetry triggers EWSB, with the resulting Goldstone bosons "eaten" by the massive W, Z gauge bosons. Because they are strongly-coupled and inherently non-perturbative, numerical lattice gauge theory provides an ideal arena in which technicolor can be explored. The maturation of lattice methods and availability of sufficient computing power has spurred the investigation of technicolor using lattice gauge theory techniques, in particular one variant known as "walking" technicolor. A technicolor model that resembles QCD is problematic that it does not satisfy the constraints of precision electro-weak observables, most notably those encapsulated by the Peskin-Takeuchi parameters, as well as the contraints on flavor-changing neutral currents. Walking technicolor is a class of models where the theory is near-conformal, *i.e.* the gauge coupling runs very slowly ("walks") over some large range of energy scales. This walking behavior produces a large separation of scales between the natural cut-off for the theory and the EWSB scale, allowing one to naturally generate fermion masses without violating contrainsts on flavor-changing neutral currents. The dynamics of walking theories may also allow it to satisfy the bounds on the Peskin-Takeuchi parameters. We discuss the results of recent lattice calculations that explore the properties of walking technicolor models and the its implications on possible physics beyond the Standard Model.