

Snowmass2021 - Letter of Interest

Novel Directions in Natural Composite Higgs Modeling

Thematic Areas:

- (TF01) String theory, quantum gravity, black holes
- (TF02) Effective field theory techniques
- (TF03) CFT and formal QFT
- (TF04) Scattering amplitudes
- (TF05) Lattice gauge theory
- (TF06) Theory techniques for precision physics
- (TF07) Collider phenomenology
- (TF08) BSM model building
- (TF09) Astro-particle physics and cosmology
- (TF10) Quantum Information Science
- (TF11) Theory of neutrino physics

Contact Information:

Devin Walker (Dartmouth College) [devin.g.walker@dartmouth.edu]

Abstract: In this white paper, we describe several new directions in natural composite model building. This includes (1) new directions in lattice gauge theory inspired composite models¹⁻⁴, (2) composite model building where the top Yukawa coupling is generated by the partial compositeness mechanism⁵⁻⁷ and (3) minimal, effective scenarios with novel UV completions and extended Higgs sectors⁸. This white paper will also focus on collider signatures that can spotlight different model building scenarios.

References

- [1] H. Gertov, A. E. Nelson, A. Perko and D. G. E. Walker, “Lattice-Friendly Gauge Completion of a Composite Higgs with Top Partners,” JHEP **02**, 181 (2019).
- [2] G. Cossu, L. Del Debbio, M. Panero and D. Preti, “Strong dynamics with matter in multiple representations: SU(4) gauge theory with fundamental and sextet fermions,” Eur. Phys. J. C **79**, no.8, 638 (2019).
- [3] Bennett, D. K. Hong, J. W. Lee, C. J. D. Lin, B. Lucini, M. Piai and D. Vadacchino, “Sp(4) gauge theories on the lattice: $N_f = 2$ dynamical fundamental fermions,” JHEP **12**, 053 (2019).
- [4] R. C. Brower, A. Hasenfratz, C. Rebbi, E. Weinberg and O. Witzel, “Composite Higgs model at a conformal fixed point,” Phys. Rev. D **93**, no.7, 075028 (2016).
- [5] A. E. Nelson, M. Park and D. G. E. Walker, “Composite Higgs Models with a Hidden Sector,” Phys. Rev. D **100**, no.7, 076015 (2019).
- [6] E. Katz, A. E. Nelson and D. G. E. Walker, “The Intermediate Higgs,” JHEP **08**, 074 (2005).
- [7] E. Katz, J. y. Lee, A. E. Nelson and D. G. E. Walker, “A Composite little Higgs model,” JHEP **10**, 088 (2005).
- [8] S. El Hedri, A. E. Nelson and D. G. E. Walker, “Reducing the quadratic divergence in the Higgs boson mass squared without top partners,” Phys. Rev. D **98**, no.3, 035029 (2018).