

Emergence of Standard Model Symmetries from Multifractal Theory

Ervin Goldfain

Advanced Technology and Sensor Group, Welch Allyn Inc., Skaneateles Falls, NY

Abstract

Despite being amply supported by all experimental results recorded to-date, the Standard Model (SM) of particle physics is beset by a host of open questions. In particular, the root cause of its $U(1) \times SU(2) \times SU(3)$ gauge content and of discrete symmetry breaking in the electroweak sector continue to defy explanation. Here we show that the answer to these questions lies in the multifractal structure of the SM near the electroweak scale.

Key words: Standard Model, scale invariance, gauge symmetries, discrete symmetries, multifractals, minimal fractal manifold.

1. Introduction.
2. Basics of multifractal theory.
3. QFT as analog of multifractal sets.
4. Scaling flows: the onset of continuous and discrete scale invariance.
5. Emergence of Lie groups from scaling flows.
6. Connection to the gauge group structure of SM.
7. Connection to the discrete symmetries of the SM.
8. Summary and conclusions.

Appendix A.

Appendix B.

References.