Georg Wieland: Gauge-invariant spectrum in the weak sector of the Standard Model

Gauge invariance requires that physical states remain composite, even for weak gauge interactions subject to the Brout-Englert-Higgs effect. In the SU(2) sector of the Standard Model, n-point functions expanded to leading order around the Higgs vacuum expectation value remain consistent with conventional perturbation theory. However, at higher orders, deviations have been observed in the purely bosonic sector, as demonstrated by both lattice and augmented perturbation theory calculations. Experimentally, it would be much easier to access fermions, but many questions regarding their behavior remain unanswered. Central to this study is the Fröhlich-Morchio-Strocchi mechanism, which offers a framework for exploring a Standard Model-like SU(2) scalar-fermion-gauge theory within a gauge-invariant approach. Lattice field theory serves as the primary tool for a non-perturbative analysis of such a theory. As a first step in this ongoing investigation, we determine and analyze the gauge-invariant spectrum of the theory.