



ID de Contribution: 20

Type: Non spécifié

# Chiral Dynamics: Do Symmetries Have to Break?

*jeudi 12 mars 2026 17:00 (20 minutes)*

Gauge-fermion theories and their IR fate remain puzzling mysteries in QFT, even after decades of study. Beyond their theoretical interest, they may play a natural role in extensions of the Standard Model, such as grand unified theories, dynamical symmetry breaking, and models of quark and lepton substructure. Yet our limited understanding of their nonperturbative dynamics severely hampers their application to realistic theories of nature. It is therefore of utmost importance to gain insight into their IR behavior. Using functional methods based on the Effective Average Action, we investigate from first principles the dynamics of a class of chiral gauge theories. Our results reveal a rich structure, ranging from IR conformality to novel patterns of chiral symmetry breaking. In addition, we find evidence for confinement without symmetry breaking, a phenomenon that may provide a natural realization of Symmetric Mass Generation and offer new perspectives on lattice regularization of chiral fermions.

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**Classification de Session:** QFT