Contribution ID: **1** Type: **not specified**

Renormalisation of Chiral Gauge Theories with Non-Anticommuting γ_5 in the BMHV Scheme at the 4-Loop Level

Wednesday 24 September 2025 14:00 (15 minutes)

The renormalisation of chiral gauge theories such as the electroweak Standard Model inevitably leads to the well-known γ_5-problem. A mathematically rigorous approach is provided by the Breitenlohner-Maison/'t Hooft-Veltman (BMHV) scheme within dimen\-sional regularisation (DReg), where full anti\-commutativity of γ_5 is abandoned. This scheme, however, explicitly breaks gauge and BRST invariance, necessitating its systematic restoration via symmetry-restoring counterterms. In this talk, I report on recent progress in extending this renormalisation programme to higher loop orders. Most notably, we have completed the full 4-loop renormalisation of an Abelian chiral gauge theory, including the explicit construction of all required counterterms, yielding a finite and BRST-invariant theory up to this order. The renormalisation of this toy model demonstrates the practical feasibility of the BMHV scheme for fully automated higher-order calculations and provides a validation of our newly developed computational setup. The results will be published soon. Using the same computational methods, we are currently working on the renormalisation of the Standard Model at the 1- and 2-loop level within the BMHV scheme. In this context, the fate of the vector-like nature of QED and QCD within the BMHV framework and the associated role of evanescent gauge interactions is discussed. Some time ago we published a study that particularly focused on the impact of such evanescent details, including the treatment of fermions in D dimensions. Ultimately, a renormalisation procedure with a self-consistent treatment of γ_5 will be essential for high-precision calculations of electroweak observables.

Primary author: WEISSWANGE, Matthias (TU Dresden)

Presenter: WEISSWANGE, Matthias (TU Dresden)

Session Classification: Parallel Sessions Wednesday Pheno 2

Track Classification: Particle Phenomenology