

Particle physics and unitarity from asymptotically safe correlation functions

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Abstract:

Asymptotic safety has made impressive progress in the past 30 years since the seminal paper by Martin Reuter. By now asymptotic safety in pure gravity and in many gravity-matter systems has been solidified in very sophisticated approximations that include a rather complete set of operators, ranging from higher order curvature invariants to fully (covariant) momentum dependent couplings. Most of these works are based on a functional renormalisation group (fRG) approach for the effective action, applied to Euclidean signature quantum gravity.

This opens the door towards comprehensive tests of asymptotically safe particle physics, including the important unitarity question. In short

(1) Is the Standard Model part of the asymptotically safe landscape and what is this set in the first place?

(2) While asymptotically safe theories are ultraviolet safe and hence valid quantum field theories, are they also unitary?

Evidently, decisive answers to this question require Minkowski signature fRG flows.

In this talk I report on the status of the Asymptotically Safe Standard Model, and on progress on scattering cross sections and unitarity from novel Minkowski signature renormalisation group flows.