

Contribution ID: 108

Type: Poster

SU(3) gauge system with twelve fundamental flavors

Tuesday 18 June 2019 17:50 (20 minutes)

We establish the conformal nature of an SU(3) gauge theory with twelve fundamental flavors by presenting final results for our gradient flow step-scaling calculation of the renormalization group beta function using domain wall fermions. The continuum limit of the s = 2 step scaling function exhibits a sign change (infra-red fixed point) around $g_c^2 \sim 5.5$ in the c = 0.25 scheme. Our calculation is based on a fully O(a²) improved set-up with Symanzik gauge action, stout-smeared Möbius domain wall fermions, Zeuthen flow, and Symanzik operator. This setup has small cut-off corrections which leads to reliable continuum extrapolations.

In addition we present a new analysis of the continuous $s \to 0 \beta$ function using the same set of ensembles. This new analysis uses only volumes $L \ge 24$ and determines the β function in a different renormalization scheme.

The continuous β function also predicts the existence of a conformal fixed point.

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Session Classification: Poster

Track Classification: Physics Beyond the Standard Model