Lattice Study for Conformal and Walking Dynamics in Large N_f Gauge Theory

A Potential Interest for Use of New Fermions

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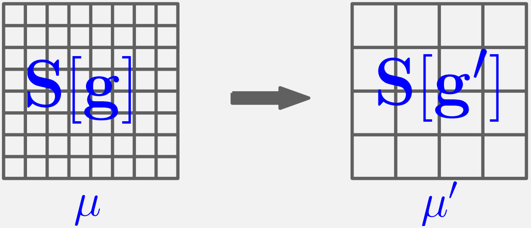
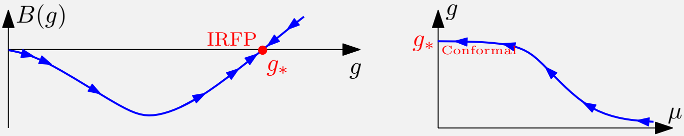
Flash Talk at YITP, Feb. 17, 2011

Gauge Theory with IRFP



$$B(g, N_c, N_f) = \mu \frac{dg}{d\mu} \ . \qquad (1)$$



Motivation: Walking Technicolor Model

$$\frac{\langle\bar{\Psi}\Psi\rangle|_{\rm ETC}}{\langle\bar{\Psi}\Psi\rangle|_{\rm TC}} = \exp\left[\int_{\Lambda_{\rm TC}}^{\Lambda_{\rm ETC}} d(\log\mu)\ \gamma\left[g^2(\mu)\right]\right] \xrightarrow{\textit{Conformal}} \left(\frac{\Lambda_{\rm ETC}}{\Lambda_{\rm TC}}\right)^{\gamma[g_*^2]} . \quad (2)$$

- **Composite Higgs:** To avoid Higgs mass hierarchy problem.
- **Walking Dynamics:** To make masses of SM fermions ($\not\ni \nu$) without large FCNC current.

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Strategy

- We investigate finite T chiral phase transitions in $N_f = 0,\ 4,\ 6,\ 8$, and 12 cases, (and more and more in future).
- The lower edge of the conformal window is extracted from a vanishing $T_c(N_f)$.
- How we compare theories with different number of flavors?
- Analytic guide: Functional Renormalization Group (J. Brawn and H. Gies ('06)).

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Critical Flavor Number N_f^*

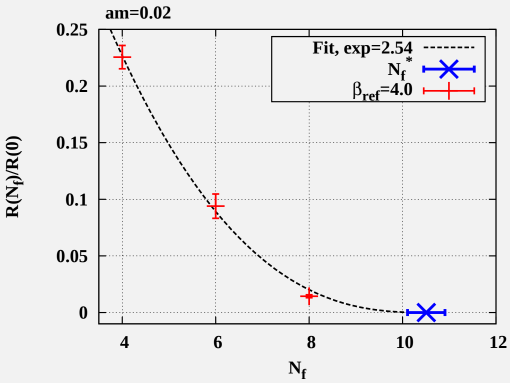

Figure: $R(N_f) \equiv T_c/\Lambda_{\mathrm{ref}}(N_f)$

$$T_c(N_f) = K|N_f - N_f^*|^{2.54}\ , \quad \text{(Braun-Geis ('11))} \tag{3}$$

$$N_f^* = 10.5 \pm 0.4\ , \quad \text{(Presnt Work)} \tag{4}$$

Welcome to Talk

Details are on Feburuary 20 (Mon),
10:45 - 11:15 !!