

# Collaborative PhD Program in Theoretical Physics

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## Walking with Many Flavors

Walking technicolor is the only viable model for technicolor without problem of excessive FCNC but has a serious problem with the S parameter. There is also a potential danger of light pseudo Nambu-Goldstone bosons some of which were believed to have no enhancement in the usual arguments of walking technicolor. Here I will talk about a possible remedy for these diseases, based on the large Nf QCD which is the only existing realistic field theoretical model for the walking technicolor. In the framework of the Schwinger-Dyson equation and the Bethe-Salpeter equation in the improved ladder approximation, we calculate the S parameter and an analogue of the  $\pi^+ - \pi^0$  mass difference  $\Delta m_{\pi^2} \equiv m_{\pi^+}^2 - m_{\pi^0}^2$  as well as the NG boson decay constant  $f_{\pi}$  on the same footing in the large Nf QCD. Approaching the chiral phase transition point  $\alpha_* \rightarrow \alpha_{cr}(= \pi/4)$  from the broken phase,  $\Delta m_{\pi^2}$  as well as  $f_{\pi^2}$  goes to zero with the essential-singularity scaling (Miransky scaling), while the ratio indicates a blowing up enhancement consistent with the inverse square root scaling,  $\delta m_{\pi^2}/f_{\pi^2} \sim (\alpha_*/\alpha_{cr} - 1)^{-1/2}$ , where  $\alpha_*$  is the gauge coupling on the infrared fixed point. On the other hand, the S parameter indicates decreasing tendency with  $(\Delta m_{\pi^2}/f_{\pi^2}) \cdot S$  being kept constant as we approach the phase transition point, which is consistent with a square root scaling,  $S \sim (\alpha_*/\alpha_{cr} - 1)^{1/2}$ , implying that the S parameter does vanish near the critical point.

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Refreshments available following the talk.