

Dilaton & Scale Invariance

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As the number of fermion fields is increased, gauge theories are expected to undergo a transition from a QCD-like phase, characterised by confinement and chiral symmetry breaking, to a conformal phase, where the theory becomes scale-invariant at large distances. In this paper, we discuss some properties of a third phase, where spontaneously broken conformal symmetry is characterised by its Goldstone boson, the dilaton. In this phase, which we refer to as conformal dilaton phase, the massless pole corresponding to the Goldstone boson guarantees that the conformal Ward identities are satisfied in the infrared despite the other hadrons carrying mass. In particular, using renormalisation group arguments in Euclidean space, we show that for massless quarks the trace of the energy momentum tensor vanishes on all physical states as a result of the fixed point.

Presenter: DEL DEBBIO, Luigi (University of Edinburgh)

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