Department of Theoretical Physics

THE QUANTUM SPACETIME SEMINAR SERIES

Symmetry non-restoration in large N gauge theories

(Zoom Seminar)

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Zoom link shall be shared separately

In many physical systems one finds that if a global symmetry is spontaneously broken at low temperatures, then it is restored at sufficiently high temperatures. The ubiquity of such symmetry restoration in nature raises the question of whether this is a universal feature of all quantum systems. In this talk, I will present examples of (3+1)-dimensional non-supersymmetric large N gauge theories which demonstrate violations of the above feature when N tends to infinity. At this limit, these theories have conformal manifolds which survive under all loop corrections to the beta functions of the couplings. I will argue that under certain conditions, a subset of points on such a conformal manifold exhibits thermal order characterized by the spontaneous breaking of a global symmetry and Higgsing of some of the gauge bosons. Furthermore, I will show that there are marginally relevant deformations of these large N CFTs which involve only the scalar fields in the model. The RG flows triggered by these deformations lead to an IR fixed point which lacks the aforementioned thermal order. Therefore, the systems defined by these RG flows undergo a transition from a disordered phase at low temperatures to an ordered phase at high temperatures. The critical temperature corresponding to this phase transition can be determined by thermal perturbation theory.