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Understanding localisation in QCD through an Ising-Anderson model

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Above the QCD chiral crossover temperature, the low-lying eigenmodes of the Dirac operator are localised, while moving up in the spectrum states become extended. This localisation/delocalisation transition has been shown to be a genuine second-order phase transition, in the same universality class as that of the 3D Anderson model. The existence of localised modes and the effective dimensional reduction can be tentatively explained as a consequence of local fluctuations of the Polyakov loop, that provide 3D on-site disorder, in analogy to the on-site disorder of the Anderson model. To test the viability of this explanation we study a 3D effective, Anderson-like model, with on-site disorder provided by the spins of an Ising model, which mimics the Polyakov loop dynamics. Our preliminary results show that localised modes are present in the ordered phase, thus supporting the proposed mechanism for localisation in QCD.

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