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Chiral symmetry breaking in QCD and related theories

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For about a decade it is known that topological fluctuations – instantons – are modified by the nonzero Polyakov line VEV and split into N_c dyons. By now there is extensive lattice literature confirming this fact and explaining certain observations by properties of such dyons, mostly at $T=(1-2)T_c$. This talk report the first direct simulations of the statistical mechanics of the “dyonic vacuum”, using one-loop partition function. We found that chiral symmetry breaking and Dirac eigenvalues spectra are strongly affected by the \overline{LL} dyon clustering. Among many consequences explaining lattice data is the dependence on the chiral transition on the number of fermion species N_f and the fermionic periodicity condition.

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