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Do fluctuations of conserved charges evidence a deconfinement?

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Above the chiral restoration crossover some cumulants of quark (baryon) number and charge fluctuations approach a free quark gas value already at $T \sim 200-250$ MeV and are considered sometimes as evidence of deconfinement. At the same time at these temperatures very clear patterns of chiral spin symmetry, which is a symmetry of the color charge and electric interactions, and which is not a symmetry of free quark gas, are observed. This symmetry suggests that degrees of freedom are chirally symmetric quarks connected by electric field into color singlet objects ("long strings").

The cumulants of conserved charge fluctuations are given by integrals of spatial correlators of conserved charge. If quarks are free these correlators demonstrate on a finite lattice remarkable diffractive patterns that are induced by quarks that are separated by a large distance. In full QCD these diffractive patterns are absent which indicates that a confining interaction does not allow quarks to be separated by a large distance. These effects are clearly visible in the correlators in a region where the correlators are suppressed by a few orders of magnitude. Hence the cumulants of conserved charge fluctuations are simply insensitive to the deep infrared region where confinement is manifest.

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