

Critical Exponents for U(1) Lattice Gauge Theory at Finite Temperature

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Abstract: For compact U(1) LGT we have performed a finite size scaling analysis on $N_\tau N_s^3$ lattices for N_τ fixed and $N_s \rightarrow \infty$, approaching the phase transition from the confined phase. For $N_\tau = 4, 5$ and 6 our data contradict the expected scenario that this transition is either first order or in the universality class of the 3D XY model. Instead our estimates of the critical exponents α/ν , γ/ν , $(1 - \beta)/\nu$, and $2 - \eta$ indicate the existence of a new, non-trivial renormalization group fixed point for second order phase transition in three dimensions. Such a fixed point would be of importance for quantum field theory as well as statistical physics. If it describes all $N_\tau \geq 4$ U(1) LGT systems in the $N_s \rightarrow \infty$ limit, a continuum quantum field theory may be defined at all temperatures.

Reference: hep-lat/0605019 (v2 in preparation).