Deconfined Criticality Flow in the Heisenberg Model

with Ring-exchange Interactions

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We perform large scale Monte Carlo simulations to study critical flows of 2D spin-1/2 J-Q model and 3D SU(2) symmetric discrete NCCPS$^1$ model, a.k.a. deconfined-critical-point (DCP) action. The flows of the J-Q model and the DCP action collapse in a significantly large region of system sizes (up to L$\sim$ 60-80$^3$), implying that the DCP theory (in general) and the discrete NCCPS$^1$ model (in particular) correctly capture mesoscopic physics of the competition between the antiferromagnetic and valence-bond orders in quantum spin systems. At larger sizes we observe significant deviations between the two flows which both demonstrate strong violations of scale invariance. Possible scenarios are outlined.