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RG scaling at chiral phase transition in two-flavor QCD

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We investigate the nature of the chiral phase transition using the RG improved gauge action and the Wilson quark action
with two degenerate quarks on $32^3 \times 16$, $24^3 \times 12$, and $16^3 \times 8$ lattices.

We introduce RG scaling relations for both the time direction and the spacial effective masses of mesons at the chiral phase transition point.
Numerical results of effective masses at the chiral phase transition on the three sizes of lattices are excellently on the universal limiting curves for the pseudo-scalar meson and vector meson, respectively, except for three data points at short distance of each lattice.
The results imply the effective masses of pion and vector meson vanishes as $1/N$ in the continuum limit with $N\,a =$ constant.
The fact that the scaling relations are satisfied and the effective masses becomes zero in the continuum limit strongly implies the transition is of second order.
When the quark is massive at the chiral phase transition in the deconfining side,
the hyper-scaling is verified with $\gamma^* \simeq 0.5$.

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