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The chiral phase transition from non-integer flavour numbers with staggered fermions

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The attempt at clarifying the order of the thermal transition in the chiral limit of QCD at zero chemical potential, with two dynamical flavours of quarks, by progressively decreasing the simulated pion mass has proven to be inconclusive because of the increasing costs of the simulations as the pion mass is lowered.

An alternative way to approach this question is to consider the path integral as a function of continuous N_f . If the transition is first order for $N_f \geq 3$, a second order transition for $N_f = 2$ requires a tricritical point in between.

The simulation of non-integer numbers of fermion flavours is easily achievable within the staggered fermion discretization. First simulations at $\mu = 0$ and $N_f = 2.8, 2.6, 2.4, 2.2$, on coarse $N_\tau = 4$ lattices, show a continuous variation of the critical mass mapping out a critical line in the $m - N_f$ plane.

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