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The phase diagram of QCD with isospin chemical potential

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We investigate the phase diagram of QCD at finite isospin chemical potential using 2+1 flavours of staggered fermions with physical quark masses at different lattice spacings and volumes. For high chemical potentials and low temperatures the confined phase shows a transition to the pion condensation phase. This phase is characterised by a proliferation of low modes that slow down the simulation considerably and necessitate the use of an infrared regulator. We discuss a novel strategy to determine the pion condensate in the limit of vanishing regulators. To investigate the convergence properties and the range of validity of the Taylor expansion method at a given order, we compare our results to the Taylor expansion for finite isospin chemical potential at 4 derivative order. This can serve as an important crosscheck for the Taylor expansion method at finite baryon chemical potential, where direct simulations are impossible due to the sign problem.

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