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Effects of composite pions on the chiral condensate within the PNJL model at finite temperature

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We investigate the effect of composite pions on the behaviour of the chiral condensate at finite temperature within the Polyakov-loop improved NJL model.
To this end we treat quark-antiquark correlations in the pion channel (bound states and scattering continuum) within a Beth-Uhlenbeck approach that uses medium-dependent phase shifts.
A striking medium effect is the Mott transition which occurs when the binding energy vanishes and the discrete pion bound state merges the continuum. This transition is triggered by the lowering of the continuum edge due to the chiral restoration transition. This in turn also entails a modification of the Polyakov-loop so that the SU(3) center symmetry gets broken at finite temperature and dynamical quarks (and gluons) appear in the system taking over the role of the dominant degrees of freedom from the pions.
At low temperatures our model reproduces the chiral perturbation theory result for the chiral condensate while at high temperatures the PNJL model result is recovered.
The new aspect of the current work is a consistent treatment of the chiral restoration transition region within the Beth-Uhlenbeck approach on the basis of mesonic phase shifts for the treatment of the correlations. Special emphasis is on the discussion of the result for the pseudocritical temperature of the chiral transition which in PNJL models at the mean field level comes out too large, in contradiction with lattice QCD results. The present approach provides a considerable improvement.

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