



Contribution ID: 65

Type: Oral talk

The order of phase transition in three flavor QCD with background magnetic field in crossover regime

Wednesday, 26 June 2019 10:10 (25 minutes)

We investigate the order of phase transition in three flavor QCD with a background U(1) magnetic field using the standard staggered action with the plaquette gauge action. We perform simulations for three volumes $N_\sigma = 8, 16, 24$ with fixed mass $ma = 0.030$ and temporal extent $N_\tau = 4$, which is expected to show crossover for vanishing magnetic field. We apply physically same magnitude of magnetic field $\sqrt{eB} = 0.9$ for each volume. We measure the chiral condensates and Polyakov loop and calculate their susceptibility and Binder cumulant. We find that the transition becomes first order like transition with hysteresis in the Monte-Carlo history from crossover for non-zero magnetic field on the system.

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Session Classification: Session 9