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Polyakov loop susceptibility and correlators in the chiral limit

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In quenched QCD the Polyakov loop is an order parameter of the deconfinement transition, but with decreasing quark mass the peak in the Polyakov loop susceptibility becomes less pronounced and it loses its interpretation as an indicator for deconfinement. In this study we examine the dependence of the susceptibility on the light quark mass, following it toward the chiral limit. In particular we are interested in whether one finds a peak in the susceptibility in this limit at all, and therefore whether the susceptibility plays any role at the chiral phase transition. Closely related is an investigation of the dependence of Polyakov loop correlations on light quark mass; our preliminary results show no dependence. From the Polyakov loop correlations one can calculate the singlet quark-antiquark free energy F_1, and the Debye mass m_D can be extracted from its long-distance behavior. Extraction of m_D is challenging because F_1 exhibits large statistical error bars at large r. We attempt to improve the signal using the gradient flow, which should leave long-range physics relatively unharmed.

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