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The effective potential of the confinement order parameter in the Hamiltonian approach

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The effective potential of the order parameter for confinement is calculated for $SU(N)$ Yang-Mills theory in the Hamiltonian approach. Compactifying one spatial dimension and using a background gauge fixing, this potential is obtained within a variational approach by minimizing the energy density for given background field. Thereby, the inverse length of the compactified dimension represents the temperature. Using Gaussian trial wave functionals we establish an analytic relation between the propagators in the background gauge at finite-temperature and the corresponding zero temperature propagators in Coulomb gauge. In the simplest truncation, neglecting the ghost and using the ultraviolet form of the gluon energy we recover the Weiss potential. We explicitly show that the neglect of the ghost drastically enhances the transition temperature. From the full non-perturbative potential (with the ghost included) we extract a critical temperature of the deconfinement phase transition of 269 MeV for the gauge group $SU(2)$ and 275 MeV for $SU(3)$.

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