

Quantum Chromodynamics (QCD) is considered to be the most promising field theory to describe the phenomenology of particles and fields subject to strong interactions. Its mathematical regularisation by introducing a discretised spacetime known as lattice QCD (LQCD) and the so-called Wilson-twisted mass (Wtm) formulation in particular have proven a most flourishing approach resulting in an ever increasing consistency of theoretical predictions with experimental data for meson and baryon masses as well as decay constants. However, explaining the phenomenology of strongly interacting matter at non-zero temperature has remained a challenging task due to both the required very high statistics and the quest for simulations close to the real physical situation at small lattice spacing and small pion mass values.

The tmfT collaboration within the given long-term project has determined the temperature range for the crossover from chirally broken and confining states at low temperature into chirally restored and deconfining states at high temperature employing Wtm LQCD with $N_f = 2$ quark flavour degrees of freedom. The hybrid Monte-Carlo simulations have been carried out at three pion masses between ~ 300 and 500MeV and for $\sim 400\text{MeV}$ at two lattice spacings. The extrapolation of the obtained pseudo-critical temperature for the chiral restoration to vanishing pion mass seems to be compatible with $O(4)$ universality. Our recent results support the observation that chiral restoration and deconfinement occur at slightly different pseudo-critical temperatures.

The next step of investigation - still for $N_f = 2$ quark flavours - is mainly devoted to establishing the equation of state for hadronic or quark-gluon matter at high temperature.