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Thermal modification of mesons and restoration of broken symmetries from spatial correlation functions with HISQ

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By using spatial correlation functions we study thermal modifications of meson states and the restoration of broken symmetries at finite temperature in 2+1 flavor QCD with the Highly Improved Staggered Quarks (HISQ) action.
The spatial correlation functions provide a direct signal for the thermal modification of meson spectral functions and indicate the restoration of chiral and U_A(1) symmetries at finite temperature.
We calculate spatial correlation functions for several meson states on lattices with aspect ratio Ns/Nt=4 in a wide temperature range of 110–170 MeV on Nt=8 and 150–400 MeV on Nt=12 with a physical strange quark mass (ms) and light quark masses (ml) set to ml=ms/20.
In pion and kaon sectors we find that the thermal modifications become obvious even below the critical temperature (Tc) and the modification of positive parity states is more significant than those of the negative parity states.
We also find that the spatial correlation functions of the vector parity partners degenerate at Tc, whereas those of the scalar parity partners show clear differences at Tc and degenerate only above 1.6Tc.
This means that the breaking of the U_A(1) symmetry is still significant at Tc.
This fact is also confirmed through simulations at the physical point (ml=ms/27).
We also discuss several properties of open-strange and open-charm mesons.
This is study on behalf of the BNL-Bielfeld Collaboration.

Primary author: Dr MAEZAWA, Yu (Yukawa Institute for Theoretical Physics, Kyoto University)

Presenter: Dr MAEZAWA, Yu (Yukawa Institute for Theoretical Physics, Kyoto University)

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