Contribution ID: **24** Type: **Talk**

Confined but chirally and chiral spin symmetric hot matter

We present properties of the quark–antiquark mesons at zero and finite temperature in the framework of a solvable chirally symmetric quark model with an interquark linearly rising interaction where the string tension is the only model parameter. We demonstrate that while the confining interaction induces spontaneous breaking of chiral symmetry at T = 0, it gets restored at a chiral restoration temperature T_ch ⊠ 90 MeV. The physical mechanism responsible for chiral symmetry restoration in the confining regime is Pauli blocking of the quark levels, required for the existence of a nonvanishing quark condensate, by thermal excitations of the quarks and antiquarks. Thus, above T_ch, meson-like states are chirally symmetric and approximately chiral spin symmetric. A crucial property of the confined meson-like light-light states above T_ch is their size that exceeds drastically that in the chirally broken phase below T_ch. Heavy-heavy mesons nearly preserve their size irrespective of the temperature. Furthermore, the root-mean-square radii of the states with J = 0 and J = 1 diverge in the chiral limit. This unexpected property must be a key to understanding unusual features of the hot QCD matter as observed at RHIC and LHC.

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Session Classification: Talks