

# Studying explicit $U(1)_A$ symmetry breaking in hot and magnetised two flavour non-local NJL model constrained using lattice results

Wednesday 27 July 2022 16:00 (25 minutes)

We study the two-flavour non-local Nambu–Jona-Lasinio (NJL) model in the presence of a magnetic field and explore the chiral crossover in presence of a non-local form of the 't Hooft determinant term [1]. Its coupling is governed by a dimensionless parameter  $c$ . This term is responsible for the explicit breaking of  $U(1)_A$  symmetry. We have attempted a systematic analysis of the model parameters by fitting to self-consistent lattice QCD calculations. Three parameters of the model are fixed by  $eB = 0$  results from published lattice QCD on the chiral condensate, the pion decay constant ( $F_\pi$ ), and the pion mass ( $m_\pi$ ). The difference of the  $u$  and  $d$  quark condensates in the presence of a magnetic field ( $eB$ ) is quite sensitive to  $c$  and we fix  $c$  using published lattice QCD results for this observable. We see no evidence that  $c$  depends on  $eB$ . The crossover temperature decreases with increasing  $eB$  only for condensate values at the lower end of the allowed values (as already seen in [Pagura:2016pwr]) and  $F_\pi$  at the upper end of the allowed values. We further check our model predictions by calculating the topological susceptibility with the fitted  $c$  values and comparing it with lattice results. Since the topological susceptibility is related to the extent of the  $U(1)_A$  symmetry breaking, we find that it is sensitive to the value of  $c$ .

M. S. Ali, C. A. Islam and R. Sharma

PRD 104, no.11, 114026 (2021) [arXiv:2009.13563].

**Authors:** AMINUL ISLAM, Chowdhury; ALI, Mahammad Sabir (Tata Institute of Fundamental Research); SHARMA, Rishi (TIFR)

**Presenter:** AMINUL ISLAM, Chowdhury

**Session Classification:** Session