

The axial anomaly and the phases of dense QCD

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The QCD axial anomaly, by coupling the chiral condensate and BCS pairing fields of quarks in dense matter, leads to a new critical point in the QCD phase diagram[1,2], which at sufficiently low temperature should terminate the line of phase transitions between chirally broken hadronic matter and color superconducting quark matter. The critical point indicates that matter at low temperature should cross over smoothly from the hadronic to the quark phase, as suggested earlier on the basis of symmetry arguments. This talk will review the arguments, in terms of a general Ginzburg-Landau effective Lagrangian, for the existence of the new critical point, as well as discuss implications for the presence of quark matter in neutron stars, and possible connections between the QCD phase structure and the BEC-BCS crossover in ultracold trapped atomic fermion systems at unitarity.

References

- [1] T. Hatsuda, M. Tachibana, N. Yamamoto, and G. Baym, Phys. Rev. Lett **97**, 122001 (2006).
- [2] N. Yamamoto, M. Tachibana, T. Hatsuda, and G. Baym, Phys. Rev. D **76**, 074001 (2007).