

Color superconducting quark matter in compact stars

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Recently, observations of compact stars have provided new data of high accuracy which put strong constraints on the high-density behaviour of the equation of state of strongly interacting matter otherwise not accessible in terrestrial laboratories [1]. Indications for high neutron star masses ($M \sim 2 M_{\odot}$) and large radii ($R > 12$ km) could rule out soft equations of state and have provoked a debate whether the occurrence of quark matter in compact stars can be excluded as well. We show that modern quantum field theoretical approaches to quark matter, including color superconductivity and a vector mean field, allow one to develop a microscopic description of hybrid stars which fulfill the new, strong constraints [2,3,4]. For these objects, color superconductivity turns out to be essential for a successful description of the cooling phenomenology in accordance with recently developed tests [5]. We discuss QCD phase diagrams for various conditions [6,7] thus providing a basis for a synopsis for quark matter searches in astrophysics and in future generations of nucleus-nucleus collision experiments such as low-energy RHIC Brookhaven and CBM @ FAIR Darmstadt.

References

- [1] T. Klähn *et al.*, Phys. Rev. C **74** (2006) 035802.
- [2] D. B. Blaschke *et al.*, Phys. Rev. C **75** (2007) 065804.
- [3] T. Klähn *et al.*, Phys. Lett. B **567** (2007) 170.
- [4] M. Alford *et al.*, Nature, **445** (2007) E7 [arXiv:astro-ph/0606524].
- [5] S. Popov *et al.*, Phys. Rev. C **74** (2006) 025803.
- [6] D. Blaschke *et al.*, Phys. Rev. D **72** (2005) 065020.
- [7] F. Sandin and D. Blaschke, Phys. Rev. D **75** (2007) 125013.