Density Profiles of a Trapped Polarized Fermi Gas

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We investigate the density profiles of a trapped asymmetric two-component Fermi gas as a function of polarization and interaction strength. The analysis is carried out at zero temperature and is based on the phase diagram of uniform systems (1) using the local density approximation. Depending on the position in the polarization-interaction plane, the system consists of a superfluid core, which can contain both an unpolarized and a polarized region, and a normal external shell where both a fully and a partially polarized gas can coexist. We determine the spatial regions corresponding to the various phases and we analyze the possible occurrence of a jump in the density profile of the spin-up and spin-down component signaling a first order phase transition. We provide comparison to the density profiles observed by the MIT group (2), corresponding to various interaction strengths, from unitarity to the BEC side of the BCS-BEC crossover.

(1) S. Pilati and S. Giorgini: Phys Rev Lett. 100(3),030401 (2008)
(2) Y. Shin, A. Schirotzek, C. H. Schunck, and W. Ketterle: Phys. Rev. Lett. 101, 070404 (2008)