学术报告

Supersolid phase and Berezinsky-Kosterlitz-Thouless phase transition in a dipolar Fermi gas

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Research Interests:
Ultracold atomic gases, low dimensional quantum fluids, quantum transport in strongly correlated materials

Abstract： Synthetic Quantum gases with Feshbach resonance provide an ideal platfor We study a two-dimensional spin-polarized Fermi gas with electric dipoles aligned by an external electric field. This system is known to exhibit three stable phases, namely the normal Fermi liquid, the p-wave superfluid and the density wave phase (stripe phase). Our study focus on two aspects of the phase diagram. First we investigate the possibility of a new zero-temperature phase in which the density wave order and the superfluid order coexist. We find that the system in the density wave phase eventually becomes unstable towards pairing as the tilting angle of the dipoles increases and the dipolar interaction becomes more attractive. Importantly, the resulting superfluid order does not destroy the density wave order, making the system a type of supersolid. We discuss possible experimental methods by which such a phase can be detected. The second part of our study concerns the finite temperature phase transition of the stripe phase. This phase can be viewed as the quantum analogue of the classical liquid crystal phase found in electronic materials. We base our analysis on the elastic energy of the system, in which the stiffness constants are determined using the self-consistent Hartree-Fock theory. The melting of this phase is driven by the proliferation of topological defects called dislocations via the so-called Berezinskii-Kosterlitz-Thouless (BKT) mechanism. We calculate the BKT critical temperature by the well-known renormalisation group equations.

[1] Z. Wu, J. K. Block and G. M. Bruun, Phys. Rev. B 91, 224504 (2015).
[2] Z. Wu, J. K. Block and G. M. Bruun, Scientific Reports 6, 19038 (2016).

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