Wigner crystals formed on helium surface: from basics to recent advances

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A Wigner crystal is a ground state of electrons formed when the long-range Coulomb repulsion dominates over kinetic energy. It was predicted by Wigner in 1934 [1] and was first realized in 1979 in a two-dimensional electron system formed a few nanometers above a surface of liquid helium [2]. Because the helium surface is free from defects or impurities, the electron system offers an ideal platform for investigating many-body phenomena, transport properties, etc without influences of disorders, and it could be a promising resource for quantum computation. The Wigner crystal has also been used for studying dynamics of quasiparticles excited in topological superfluid 3He [3].

In this talk, I will discuss fundamental properties and recent advances of Wigner crystals formed on liquid helium. After giving basic introduction of the Wigner crystal, I will present recent progresses on nonlinear transport phenomena arising from coupling of the Wigner crystal with a soft helium surface [4]. I will also talk about melting phenomena of electrons confined in a small region, such as reentrant melting in a quasi-one-dimensional geometry [5].

References

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