
Fractional quantum Hall effect and Wigner crystallization in suspended Corbino graphene disk

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Abstract

Competition between kinetic and Coulomb energy in two-dimensional electron system leads to a multitude of different ordered phases. At high magnetic fields, kinetic energy of electrons is suppressed, which favors crystallization of electrons *i.e.* Wigner crystal. However, electrons commonly favor an incompressible liquid state, the fractional quantum Hall (FQH) liquid, instead of the Wigner crystal solid phase.

We have investigated competing Wigner crystal and FQH liquid phases in monolayer suspended graphene devices in Corbino geometry [1]. Magneto- and transconductance measurements along with IV characteristics and mechanical resonances all indicate unconventional sequence of FQH phases with lowering electron density n , where the conventional sequence of FQH states is interrupted by Wigner crystal order. At small n , with the filling factor $\nu \sim 0.15 - 0.16$, the electron crystallizes into ordered Wigner solid, while incompressible liquid state is reemerged with lowering density down to $\nu \sim 1/7$. The Wigner crystal state was experimentally confirmed by a microwave absorption resonance near 3 GHz which agrees with pinned, submicron-sized crystallites. The interaction of Wigner crystal and FQH states with mechanical vibrations has also been investigated. [1] M. Kumar, A. Laitinen, and P. J. Hakonen, *Fractional quantum Hall effect and Wigner crystallization in suspended Corbino graphene disk*, arXiv:1611.02742.

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