Joint CQSE and CASTS Seminar

Weekly Seminar
Jan. 5, 2018 (Friday)

TIME Jan. 5, 2018, 14:30 ~ 15:30
TITLE Fractional quantum Hall states in bilayer graphene and their possible applications in quantum computation
SPEAKER Prof. Chi-Te Liang
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Abstract

The fractional quantum Hall (FQH) effect is a canonical example of electron-electron interactions producing new ground states in many-body systems. To date, most FQH studies have focused on the N=0 Landau level (LL). In this talk, I shall report transport measurements of FQH states in the N=2 LL (filling factors $4<|\nu|<8$) in bilayer graphene, a system with spin and valley degrees of freedom in all LLs, and an additional orbital degeneracy in the 8-fold degenerate N=0/N=1 LLs. The FQH states we observe in the N=2 LL form a complete sequence of particle-hole symmetric states whose relative strength is dependent on their denominators. The FQH states in the N=2 LL display energy gaps of a few Kelvin, comparable to and in some cases larger than those of fractional states in the N=0/N=1 LLs. The FQH states we observe form, to the best of our knowledge, the highest set of particle-hole symmetric pairs seen in any material system [Ref. 1]. At the end of this talk, I shall describe even-denominator FQH states observed in bilayer graphene and their possible applications in quantum computation [Refs. 2-4].

[1] G. Diankov, C.-T. Liang, F. Amet, P. Gallagher, M. Lee, A. J. Bestwick, K. Tharratt, W. Coniglio, J. Jaroszynski, K. Watanabe, T. Taniguchi, and D. Goldhaber-Gordon, *Nat. Commun.* **7**, 13908 (2016).
[2] D. K. Ki, V. I. Fal'ko, D. A. Abanin, and A. F. Morpurgo, *Nano Lett*. **14**, 2135 (2014).
[3] Y. Kim, D. S. Lee, S. Jung, V. Skákalová, T. Taniguchi, K. Watanabe, J. S. Kim, and J. H. Smet, *Nano Lett*. **15**, 7445 (2015).
[4] J. I. A. Li, C. Tan, S. Chen, Y. Zeng, T. Taniguchi, K. Watanabe, J. Hone, and C. R. Dean, *Science* **358**, 648 (2017).