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Twisted Bilayer Graphene - Topological Change of Fermi Surface and Lift of Layer Degeneracy[1] PILKYUNG MOON, New York University, Shanghai, MIKITO KOSHINO, Tohoku University, YOUNGWOOK KIM, PATRICK HERLINGER, JURGEN H. SMET, Max Planck Institute for Solid State Research, TAKASHI TANIGUCHI, KENJI WATANABE, National Institute for Materials Science — Van Hove singularities (vHs) play a diverse role for the electronic properties of crystals, but typical materials require unfeasibly large electron density to reach vHs. When two atomic layers are stacked in an incoherent way, however, the order of the electron density to reach vHs becomes several order smaller. This is because the moiré interference between the lattices makes a new class of superlattices with an exceptionally long periodic potential.[2] In this talk, we systematically investigate the magnetotransport of twisted bilayer graphene. A topological phase transition at vHs is disclosed in the abrupt conversion of electrons to holes, a loss of a non-zero Berry phase and distinct sequences of integer quantum Hall states above and below the singularity. Moreover, we reveal the origin of the anomalous sequence of the Hall conductivity.[3]

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[2]P. Moon and M. Koshino, Phys. Rev. B 85, 195458 (2012), Phys. Rev. B 87, 205404 (2013); C. R. Dean et al., Nature 497, 598 (2013); B. Hunt et al., Science 340, 1427 (2013).
[3]Y. Kim et al., Nano Lett. 16, 5053 (2016)

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