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Doping and Field Dependent Electrical Conductivity of Angle-Resolved Twisted Bilayer Graphene LUJIE HUANG, CHEOL-JOO KIM, Cornell, ADAM WEI TSEN, Columbia, LOLA BROWN, JIWOONG PARK, Cornell — In twisted bilayer graphene (tBLG), the interlayer interaction induces additional van Hove singularities (VHS) and mini-gaps near the intersections between the Dirac cones of the two layers; this results in several electrical and optical phenomena at an energy level that monotonically increases with the twist angle θ. While there exist previous studies on the electrical and optical properties of tBLG, the electrical conductivity of tBLG and its dependence on the overall doping and interlayer potential (field) have not been measured using tBLG samples with known θ. Here, we report the electrical conductivity of θ-resolved tBLG in a dual-gate field effect transistor geometry which allows an independent control of the doping and interlayer potential. In largeθ tBLG, the total conductivity is approximately proportional to the total carrier density (the sum of the carrier number densities from the top and the bottom layers), indicating that largeθ tBLG acts as two independent single layers carrying the electrical current in parallel. Among tBLG samples with a small θ, however, we observe an extra resistance peak besides the Dirac point, which may correspond to the minigap near the VHS. In order to perform further experiments for this small-θ tBLG samples, we use a doubletransfer of CVD grown graphene films with a uniform lattice orientation over a large scale. This allows a direct optical characterization in the relevant IR wavelengths, a critical capability for determining and the twist angle θ.

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