Transport in magic angle twisted bilayer graphene

Euyheon Hwang

Sungkyunkwan University, Department of Nanoscience and engineering, Suwon, Korea

euyheon@skku.edu

Abstract

We present the density and temperature dependent resistivity of twisted bilayer graphene by considering the effect of moire superlattice structure. We theoretically show that twisted bilayer graphene should have an enhanced and strongly twist-angle dependent linear-in-temperature resistivity in the metallic regime with the resistivity magnitude increasing as the twist angle approaches the magic angle. The slope of the resistivity versus temperature could approach one hundred ohms per kelvin with a strong angle dependence, but with a rather weak dependence on the carrier density. This higher-temperature density-independent linear-in-T resistivity crosses over to a T^4 dependence at a low density-dependent characteristic temperature, becoming unimportant at low temperatures. This angle-tuned resistivity enhancement arises from the huge increase in the effective electron-acoustic phonon coupling in the system due to the suppression of graphene Fermi velocity induced by the flatband condition in the moire superlattice system. The calculated linear-in-T resistivity is arising from the ordinary electron-phonon coupling in a rather unusual parameter space due to the generic moire flatband structure of twisted bilayer graphene.

References

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