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Asymmetric Electron Transport Induced by Friedel Oscillations at Monolayer-Bilayer Heterojunctions of Epitaxial Graphene KENDAL CLARK, X.-G. ZHANG, Oak Ridge National Laboratory, GONG GU, University of Tennessee, GUOWEI HE, RANDALL FEENSTRA, Carnegie Mellon University, AN-PING LI, Oak Ridge National Laboratory — We report asymmetric electron transport upon bias polarity reversal at individual monolayer-bilayer (ML-BL) boundaries in epitaxial graphene on SiC (0001), revealed by multi-probe scanning tunneling potentiometry. A greater voltage drop is observed when the current flows from ML to BL graphene than in the reverse direction, and the difference remains nearly unchanged when bias exceeds a threshold. This is not a typical nonlinear conductance due to electron transmission through an asymmetric potential. Rather, it indicates the opening of an energy gap at the Fermi energy. Our theoretical analysis finds that Friedel charge oscillation opens a gap for electrons with wave vectors perpendicular to the boundary. The Friedel gaps are different on the ML and BL sides, which can shift under bias and lead to asymmetric transport upon reversing the bias polarity. A quantitative agreement is seen between experiment and theory on both the sign and the magnitude of the asymmetry.

An-Ping Li
Oak Ridge National Laboratory

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