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Theory of the electronic and transport properties of epitaxial graphene¹

MARCO BUONGIORNO NARDELLI, North Carolina State University

Advances in the epitaxial growth of graphene films on SiC have the potential to open new classes of device applications that may revolutionize the semiconductor roadmap for future decades. However, this progress will require an in-depth understanding and utilization of the electronic processes that take place at the nanoscale. In this talk I will review our recent results on the electronic and transport properties of epitaxial graphene on SiC. Using calculations from first principles, I will discuss the role of the interface buffer layer in the tuning of the band alignment and the magnetic doping at the heterojunction; I will describe the effect of electron-phonon interactions in mono- and bi-layer graphene in determining the intrinsic carrier-phonon scattering properties of this material and thus the ultimate limit of any electronic device; finally, I will briefly discuss the thermal properties of the graphene/SiC interface, since understanding of the heat transfer properties is essential for optimal thermal management and heat removal in device applications.

¹Work done in collaboration with K.W. Kim, T. Jayasekera, J. Mullen, K. Borysenko, S. Xu, X. Li and B.D. Kong