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New Directions in Epigraphene Nanoelectronics

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Epigraphene (i.e. graphene grown epitaxially on silicon carbide) is an increasingly active field in 2D electronics research. Its conception at Georgia Tech predates conventional graphene research by several years. It remains the most promising direction to realize high-performance graphene electronics. Its outstanding feature is, that it utilizes electronics-grade single-crystal silicon carbide as a substrate, on which the graphene is grown by several techniques to produce one or more graphene layers in registry with selected silicon carbide crystal faces. These epitaxial growth methods are used to insure an atomically perfect substrate on top of which graphene is grown in perfect alignment, which is a *sine qua non* for high-performance nanoelectronics. The past decade has shown that the properties of epigraphene are vastly superior and more robust than conventional graphene, and currently it is the only form of graphene that has produced a commercially viable electronic device (a quantum Hall resistance standard). This first success is only the beginning. The recently discovered exceptional ballistic transport properties discovered in nanopatterned graphene ribbons [1], have rekindled effort to exploit these unusual effects in graphene nanostructures. While the understanding of the transport is only rudimentary, it appears quite possible that processes may be involved with profound consequences for future nanoelectronics. In this talk the status quo and new directions that we are taking to realize the ultimate vision of epigraphene nanoelectronics will be addressed.

[1] Baringhaus *et al.* Nature **506**, 349 (2014).