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Structured epitaxial graphene and ballistic transport

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Graphene nanostructures are essential components in graphene-based nano-electronics devices. However, progress has essentially been halted due to poor carrier mobility mainly associated with ribbon edge roughness. On the contrary, graphene nano-ribbons epitaxially grown on SiC are ballistic conductors on distances greater than 10 µm, even at room temperature. Low tem[erature transport experiments indicate that the electronic conductance is dominated by two components, one that is ballistic and temperature independent, and the second that is thermally activated. Long ribbons present striking similarities with (edgeless) carbon nanotubes. These properties appear to be related to the lowest energy quantum states in the charge neutral ribbons. Tunnel magneto-conductance with magnetic contacts also exhibits a spin-switch behavior, indicating that the ribbons possess a spin component consistent with the long ribbon single channel conductance. Besides their importance for fundamental science, epigraphene nano-ribbons are readily produced by the thousands and their room temperature ballistic transport properties are promising for advanced nano-electronics.

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