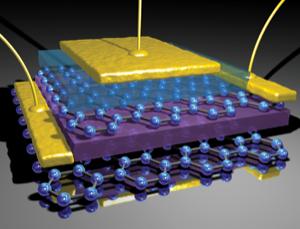
**Graphene: Entering Flatland**

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Graphene-based transistors could be much faster than silicones - and are already becoming reality *(Image: TL Ponomarenko)*

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Although its properties and potential earn it the title of a wonder material, graphene on its own is only the beginning. Perhaps the most exciting vistas open up when it is modified, either chemically or structurally, to produce new materials. For instance, we could interface graphene with other engineered forms of carbon such as nanotubes and buckyballs to make three-dimensional scaffolds with electronic and structural properties that are hard to predict from the outset. At the same time, tinkering with graphene's electronic properties using strain or pressure - "strain engineering" - is a field very much in its infancy.

Graphene is one inhabitant of an exciting new world we are entering as we hone our abilities to manipulate material on the nanoscale. This is the realm of two-dimensional crystals - individual atomic planes pulled out from more conventional three-dimensional solids. Other instances include copper oxide, or cuprate, layers with their [little-understood ability to conduct without resistance at temperatures 100 or more degrees above absolute zero](http://www.newscientist.com/article/mg21228370.300-superconductors-getting-warmer.html); and [manganites](http://www.newscientist.com/article/mg18825274.500-hot-superconductor-surprise-baffles-physicists.html), whose dramatic changes in electrical resistance when a magnetic field is applied to them make them the basis for the hard drives in the latest wave of smartphones and tablet computers. Just like graphene, these two-dimensional materials are likely to have unusual and useful properties; some will be metallic, some insulating, some semiconducting. There may even be some that are magnetic, superconducting or perhaps some combination of these.

Once the properties of these materials as single planes have been investigated, there is the prospect of combining them to produce layered three-dimensional materials unknown in nature, with made-to-order complex behaviours. We might imagine, for example, a three-layer structure: first, a transparent and conducting graphene-like layer; second, a layer fine-tuned to transform the light that passes through the first layer into electricity; and finally a third layer with optimised conduction properties to carry this electricity to a storage unit. In this way, we would be a long way towards doing what a plant does to harvest the sun's energy - photosynthesis - but on a structure a million times thinner than a human hair.

A whole new universe of materials is there to be explored; what we will find there is limited only by our imagination.