

# Graphene Progress

A. K. Geim

*Centre for Mesoscience & Nanotechnology, University of Manchester, United Kingdom*

Graphene – a free-standing atomic plane of graphite – has turned out to be a wonder material. It has already attracted many superlatives to its name. It is of course the thinnest material in the universe and arguably the strongest one ever measured. Its charge carriers exhibit the highest intrinsic mobility ( $>200,000 \text{ cm}^2/\text{Vs}$ ), have zero effective mass and can travel micron distances without scattering at room temperature. Graphene can sustain current densities million times higher than that of copper ( $\sim 1 \mu\text{A}$  through each carbon chain), shows record thermal conductivity and stiffness, is impermeable to gases and reconciles such conflicting qualities as brittleness and ductility. Electron transport in graphene and its bilayer is described by massless and massive Dirac-like equations, respectively (rather than the standard Schrodinger equation), which allows the investigation of relativistic quantum phenomena in a bench-top experiment.

I will overview progress in graphene research over the last two years concentrating on its fascinating electronic and optical properties, and using for illustration mostly the results obtained by our team in Manchester. In addition, I will attempt to describe the rapidly developing area of graphene applications.

[1] A. K. Geim, *Science* 324, 1530 (2009). A. K. Geim, K. S. Novoselov, *Nature Mater.* 6, 183 (2007).