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**Electric Field Effect in Planar Single-Layer Graphene** ANDRE GEIM, KOSTYA NOVOSELOV, DA JIANG, YAUN ZHANG, TIM BOOTH, IRINA GRIGORIEVA, University of Manchester, UK, SERGEY MOROZOV, ANATOLY FIRSOV, SERGEY DUBONOS, Institute for Microelectronics Technology, Chernogolovka, Russia — We describe free-standing single-layer crystals of graphene, which are one carbon atom thick but extend over many microns laterally. This two-dimensional fullerene macromolecule is obtained by mechanical exfoliation and allows standard microfabrication procedures, as described in our earlier paper in Science **306**, 666 (2004). We have found graphene to be stable under ambient conditions, conductive and of remarkably high quality. Using graphene films, we have fabricated transistor-like devices and studied their properties from room to liquid-helium temperatures. Graphene exhibits a strong ambipolar electric-field effect with room-temperature mobilities of electrons and holes up to $\approx$10,000 cm$^2$/Vs, which implies ballistic transport over submicron distances. At low temperatures, we have observed pronounced Shubnikov-de Haas oscillations and well-developed plateau-like features, indicating onset of the quantum Hall effect. Graphene is found to be a zero-gap 2D semiconductor. Analysis of the quantum oscillations also indicates the linear, Dirac-like spectrum of its carriers.

Andre Geim
University of Manchester

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