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Detection of Individual Gas Molecules Absorbed on Graphene ANDRE GEIM, KOSTYA NOVOSELOV, FRED SCHEDIN, SERGEY MORO-ZOV, DA JIANG, ERNIE HILL, University of Manchester — The ultimate aspiration of any detection method is to achieve such a level of sensitivity that individual quanta of a measured value can be resolved. In the case of chemical sensors, the quantum is one atom or molecule. Such resolution has so far been beyond the reach of any detection technique, including solid-state gas sensors hailed for their exceptional sensitivity. The fundamental reason for this is fluctuations due to thermal motion of charges and defects which lead to intrinsic noise exceeding the sought-after signal from individual molecules usually by many orders of magnitude. We describe micron-size sensors made from graphene, which are able to detect individual events when gas molecules attach to graphene's surface at room temperature. The absorbed molecules change the local carrier concentration by one electron, which leads to clear step-like changes in resistance. The achieved sensitivity is due to the fact that graphene is an exceptionally low-noise material, which makes it a promising candidate not only for ultra-sensitive chemical detectors but also for other applications where local probes sensitive to external charge or magnetic field are required.

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