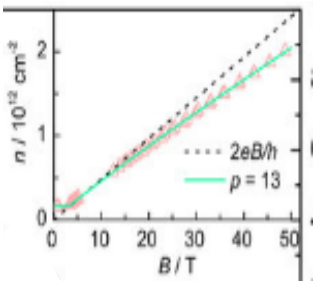
National Physical Laboratory

News from NPL for the CCEM, 22-24 March 2017

NPL is constructing new laboratory facilities for its Quantum Metrology Institute (QMI). The image shows an artist's impression of the buildings which consist of a refurbished existing laboratory and a purpose-built extension. The role of the QMI is to provide a link to the UK national programme to develop and commercialise quantum technologies and also to establish and share key facilities for the test and validation of quantum technologies. The research programme of the QMI includes: atomic clocks, ion trapping and femtosecond combs; atomic magnetometry, nanoSQUIDs and NEMS; semiconductor microtraps, quantum communications and superconducting qubits; properties of quantum materials; realisation of quantum electrical standards for metrology. The facilities will open in 2018.



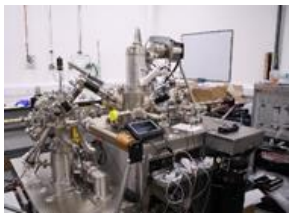
The Quantum Detection Group has published a paper on the generation of giant quantum Hall plateaus by charge transfer in Epitaxial graphene. Despite Epitaxial graphene being the best candidate for quantum electrical resistance standards one key underlying mechanism, a magnetic field dependent charge transfer process, is yet to be fully understood. This paper reported measurements with an almost linear increase in carrier density with magnetic field (see graph) providing strong evidence for field dependent charge transfer. This result helps explain how the substrate impacts graphene and enables scientists to correct for this effect to achieve greater accuracy for both factory standards and ultimately precision at higher fields and lower temperatures. Scientific Reports 6, Article number: 30296 (2016) doi:10.1038/srep30296


ギガ領域で最高精度
シリコン単電子転送素子
電流再定義へ一歩
NTTなど

Research featuring the first accurate measurements on silicon single-electron pumps at 1 ppm level in collaboration with NTT has been published in Applied Physics Letters. This represents an important step towards the universality test of single-electron-based current standard and significantly, in a country with strong electronics export industry, news articles of this work were also published in two Japanese industrial papers (Nikkei Business Daily and Nikkan Kogyo Shinbun, see picture).
Appl. Phys. Lett. 109, 013101 (2016); doi: http://dx.doi.org/10.1063/1.4953872

The Nonlinear Microwave Measurements and Modelling Laboratories (n3m-labs) – has been launched at NPL and the University of Surrey to help develop the next generation of super-efficient electronic circuits for next-generation wireless communications. The n3m-labs facility comprises staff and equipment located at both NPL and the Advanced Technology Institute, Surrey. The event was attended by NPL's CEO and Surrey's Vice-Chancellor and featured a keynote speech by the CTO of Sony Europe, who spoke about the new wireless world of the future and the importance of semiconductor device design, and emphasised how the new facility at NPL and Surrey will play a key role in this future.

The Electromagnetics Group has installed a primary radio frequency (RF) attenuation measurement system at the National Metrology Institute of South Africa (NMISA). Attenuation standards, together with those for noise, impedance and power, underpin almost all reliable microwave measurements made today. Based on the state-of-the-art system at NPL, the new system at NMISA was constructed using both commercially-available equipment and bespoke hardware designed by NPL and built by Ultratest. Reliable microwave measurements are essential to the performance and advancement of a range of technologies, from smartphones and wireless networks to GPS and remote sensing.



NPL has recently invested in new nanoprobe facilities for optical and electrical metrology. This new facility provides nanoscale measurements and aims to provide a physical interface between the advanced low-dimensional materials, nanofabricated devices and the macroscopic scale accessible by electrical metrology.