MAR14-2013-020242

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

**Imaging quantum transport using scanning gate microscopy**

BENOIT HACKENS, IMCN/NAPS, Universite catholique de Louvain, Louvain-la-Neuve, Belgium

Quantum transport in nanodevices is usually probed thanks to measurements of the electrical resistance or conductance, which lack the spatial resolution necessary to probe electron behaviour inside the devices. In this talk, we will show that scanning gate microscopy (SGM) yields real-space images of quantum transport phenomena inside archetypal mesoscopic devices such as quantum point contacts and quantum rings. We will first discuss the SGM technique, which is based on mapping the electrical conductance of a device as an electrically-biased sharp metallic tip scans in its vicinity. With SGM, we demonstrated low temperature imaging of the electron probability density and interferences in embedded mesoscopic quantum rings [B. Hackens et al., Nat. Phys. 2, 826 (2006)]. At high magnetic field, thanks to the SGM conductance maps, one can decrypt complex transport phenomena such as tunneling between quantum Hall edge state, either direct or through localized states [B. Hackens et al., Nat. Comm. 1, 39 (2010)]. Moreover, the technique also allows to perform local spectroscopy of electron transport through selected localized states [F. Martins et al., New J. of Phys. 15, 013049 (2013); F. Martins et al., Sci. Rep. 3, 1416 (2013)]. Overall, these examples show that scanning gate microscopy is a powerful tool for imaging charge carrier behavior inside devices fabricated from a variety of materials, and opens the way towards a more intimate manipulation of charge and quasiparticle transport. This work was performed in collaboration with F. Martins, S. Faniel, B. Brun, M. Pala, X. Wallart, L. Desplanque, B. Rosenow, T. Ouisse, H. Sellier, S. Huant and V. Bayot.