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「機械システム・イノベーション」

GMSI

最先端融合科学イノベーション
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Spin gating of mesoscopic devices

Professor Mats Jonson

Department of Physics, University of Gothenburg

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Electrical currents through nanoscale devices can easily be controlled electrostatically by using ”gate electrodes”. When charged (”charge gating”) these give rise to electric fields that couple to the charge of the electrons via the Coulomb interaction and can therefore be used (for example) to turn on and off the so called Coulomb blockade of electron tunneling and hence the current in mesoscopic devices. Since electrons carry spin (a tiny magnetic moment) as well as charge it is interesting to consider whether one could manipulate electronic currents by coupling to the spin of the electrons (”spin gating”) rather than to their charge. In this talk two potential spin-gating mechanisms will be considered. These are (i) the magnetic exchange interaction in magnetic devices and (ii) the spin-orbit coupling (”Rashba effect”), which is prominent in low-dimensional conductors. Possible implementations of spin gating, involving spin-flip assisted electro- and photo-mechanical effects, ”Rashba spin splitting” of single electrons and Cooper pairs, and spin-gating of superconducting weak links, will be discussed.

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本件連絡先: 東京大学大学院工学系研究科機械工学専攻 教授 丸山 茂夫
GMSIプログラム事務局 E-mail: office@gmsi.t.u-tokyo.ac.jp Phone: 03-5841-0696