CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

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Mercredi 28 octobre 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Hybrid single-electron turnstile

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First I discuss various candidates of single-electron current pumps for quantum metrology. Then I focus on the hybrid normal-metal-superconductor turnstile in the form of a one-island single-electron transistor with one gate [1-3]. The device demonstrates robust current plateaus at multiple levels of ef at frequency f. I discuss the various error mechanisms, based on our experiments and theoretical considerations. Ultimately the quantization accuracy is expected to be limited by either two-electron tunneling or by Cooper-pair-electron co-tunneling [4]. We predict that it should be possible to achieve the metrological accuracy of 10^{-8}, while maintaining the quantized current on the level of more than 10 pA, just by one turnstile with realistic parameters using aluminium as a superconductor. Recently we have managed to run ten turnstiles in parallel increasing the current level to above 100 pA [5]. Work on suppressing the harmful sub-gap leakage current is in progress with encouraging experimental results. [1] J.P. Pekola, J.J. Vartiainen, M. Möttönen, O.-P. Saira, M. Meschke, and D.V. Averin, Nature Physics 4, 120 (2008). [2] A. Kemppinen, M. Meschke, Möttönen, D.V. Averin, and J.P. Pekola, arXiv:0803.1563, The European Physical Journal - Special Topics 172, 311 (2009). [3] S.V. Lotkhov, A. Kemppinen, S. Kafanov, J.P. Pekola, and A.B. Zorin, Appl. Phys. Lett. 95, 112507 (2009). [4] D.V. Averin and J.P. Pekola, Phys. Rev. Lett. 101, 066801 (2008). [5] V.F. Maisi, Yu.A. Pashkin, S. Kafanov, J.S. Tsai, and J.P. Pekola, arXiv:0908.2357.
