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

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Jeudi 4 juin 14h00

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Dephasing in the electronic Mach-Zehnder interferometer

Florian Marquardt

In this talk, I will first give an introduction to dephasing, i.e. the loss of quantum-mechanical phase coherence by a fluctuating environment. I will then turn to the electronic Mach-Zehnder interferometer which has become a prime tool to investigate dephasing of ballistic electrons in the solid state environment. Two aspects will be discussed in more detail:

When dephasing is due to the shot noise of an adjacent edge channel, the discreteness of charges implies that the potential fluctuations are non-Gaussian. We have shown that this leads to oscillations in the interference contrast of the interferometer, in contrast to naive expectations.

At high bias voltages, we deal with dephasing in a strongly nonequilibrium situation. We have analyzed dephasing by electron- electron interactions in that situation using a straightforward and physically transparent 'semiclassical' approach. The Green's function (i.e. the interference contrast) of a chiral interacting one-dimensional fermion system (edge channel) obeys a power-law decay at high energies, at zero temperature. Surprisingly, we find that the exponent is universal, i.e. independent of the interaction strength, for (almost) arbitrarily shaped interaction potentials.

[1] "Controlled Dephasing of Electrons by Non-Gaussian Shot Noise", I. Neder, F. Marquardt, M. Heiblum, D. Mahalu, and V. Umansky, Nature Physics **3**, 534 (2007) [2] "Coherence oscillations in dephasing by non-Gaussian shot noise", I. Neder and F. Marquardt, New Journal of Physics **9**, 112 (2007) [3] "Universal Dephasing in a Chiral 1D Interacting Fermion System", Clemens Neuenhahn and Florian Marquardt, Physical Review Letters **102**, 046806 (2009)

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