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Service de Physique de l'Etat Condensé

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SÉMINAIRE EXCEPTIONNEL

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Lundi 4 Février 2013 à 11h

Orme des Merisiers SPEC Amphi Bloch, Bât.774

Electron-Nuclear Dynamics in a Double Quantum Dot and Dynamic Charge Transport in Quantum Hall Edge Channels

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Part I: Electron-Nuclear Dynamics in a Double Quantum Dot

A two-electron system in a double quantum dot is attractive to study electron spin dynamics especially for qubit applications. However, electron spins are interacting with nuclear spin ensemble of the host material, whose fluctuation induces dephasing problem for the electronic states. This electron-nuclear system exhibits curious non-linear dynamics, which is studied in this work by investigating transient current and its noise. Stable feedback in the spin-blockade regime can be used to prepare identical polarization of the two dots. In contrast, unstable dynamics in the shallow Coulomb blockade regime causes a significant accumulation of nuclear spin polarization, dominantly in one of the two dots, whose Overhauser field spontaneously cancels the external magnetic field. Overhauser field perpendicular to the external magnetic field can be significant to lift the spin blockade completely.

Part II: Dynamic Charge Transport in Quantum Hall Edge Channels

Charge transport in one-dimensional channels can be understood in terms of collective charge excitation called plasmons. Edge channels in the integer quantum Hall regime, where edge magnetoplasmons can be excited, are attractive for their flexible channel geometry, unidirectional (chiral) transport without backscattering, tunable plasmon velocity, and controllable interaction between as well as inside the channels. These charge dynamics in multi-channel configurations are investigated by time- and/or frequency-resolved charge transport measurements. When two counter-propagating edge channels are coupled with Coulomb interaction, the system can be well described in terms of Tomonaga-Luttinger liquid, where coupled modes of left-mover and right-mover are formed. Connection to normal non-interaction channels consequently causes charge reflection called fractionalization. We have successfully observed the charge fractionalization in our time-resolved experiments.

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