CEA - Saclay 91191 Gif-sur-yvette Cedex

Service de Physique de l'Etat Condensé

SÉMINAIRE

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Mercredi 8 juin 11h15

Orme des Merisiers SPEC Salle Itzykson, Bât.774

Strong back-action of a linear circuit on a single electronic quantum channel

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How are the transport properties of a coherent conductor modified by its surrounding circuit? This fundamental question is also of practical importance for the engineering of composite quantum devices. When a coherent conductor is inserted into a circuit, its conductance is reduced due to the circuit back-action in response to the granularity of charge transfers. This phenomenon, called dynamical Coulomb blockade, has been extensively studied for a tunnel junction. However, for arbitrary short coherent conductors, it is fully understood only in the limit of small conductance reductions and low-impedance surrounding circuits. We have investigated experimentally the strong back-action regime of a linear circuit on a single electronic conduction channel of arbitrary transmission. This was achieved by using a quantum point contact (QPC) as a test-bed for coherent conductors. The QPC was embedded in an adjustable on-chip circuit of impedance comparable to the resistance quantum R_K= h/e² at microwave frequencies, leading to conductance reductions up to 90%. A capacitively coupled metallic gate was used as a switch to shunt the surrounding circuit. This in-situ short-circuit technique allows us to extract the back-action signal in the most direct way, by probing the QPC conductance in presence and in absence of the circuit back-action. Our experiment shows important deviations from calculations performed in the weak back-action framework. From our results, we propose a generalized expression for the conductance of an arbitrary single quantum channel embedded in a linear environment. The proposed expression is in good agreement with recent predictions derived for a purely ohmic environment.

A coffee break will be served at 11h00. The seminar will be given in English.

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