

CEA - Saclay 91191 Gif-sur-yvette Cedex  
**Service de Physique de l'Etat Condensé - UMR 3680**

## SÉMINAIRE

Mercredi 4 novembre 2015 à 11h15

**Orme des Merisiers SPEC, Salle Itzykson, Bât.774**

**Frédéric PIERRE**

*Laboratoire de Photonique et Nanostructures - CNRS UPR 20*

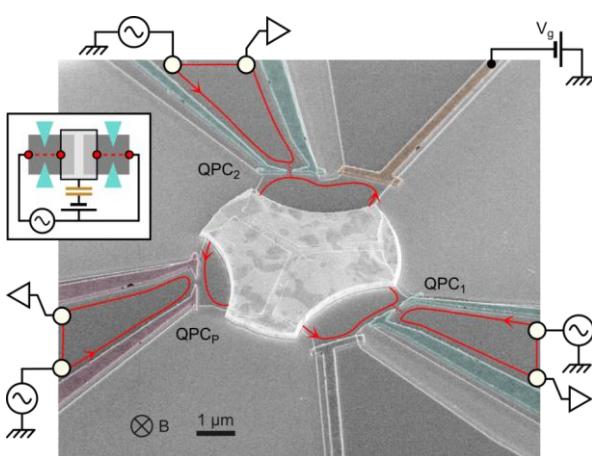
## Two-channel Kondo effect with macroscopic quantum charge states

Many-body correlations and macroscopic quantum behaviors are fascinating condensed matter problems. A powerful test-bed for the many-body concepts and methods is the Kondo model which entails the coupling of a quantum impurity to a continuum of states. This paradigmatic example of renormalization group physics is also central in highly correlated systems and can be explored with tunable nanostructures.

Although Kondo physics is usually associated with the hybridization of itinerant electrons with microscopic magnetic moments, theory predicts that it can arise whenever degenerate quantum states are coupled to a continuum. Here I will present an experiment demonstrating the previously elusive 'charge' Kondo effect, where the Kondo impurity is a quantum pseudospin of 1/2 constituted by two macroscopic charge states of a metallic island tuned at degeneracy.

In contrast to other Kondo nanostructures, each conduction channel connecting the island to an electrode constitutes a distinct and fully tunable Kondo channel, thereby providing an unprecedented access to the two-channel Kondo effect and a clear path to multi-channel Kondo physics. Using a weakly

coupled probe, we reveal the renormalization flow, as temperature is reduced, of two Kondo channels competing to screen the charge pseudospin. This provides a direct view of how the predicted quantum phase transition develops across the symmetric quantum critical point. Detuning the pseudospin away from degeneracy, we demonstrate, on a fully characterized device, quantitative agreement with the predictions for the finite-temperature crossover from quantum criticality.



**Figure.** Colorized SEM picture of the device: a hybrid metal-semiconductor single-electron transistor (schematic in inset) with additional characterization gates

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