



**Sonderforschungsbereich 631**  
Festkörperbasierte Quanteninformationsverarbeitung



**Dienstag 16. Januar 2007**

**14 Uhr 00**

Seminarraum 318, Theresienstr. 37

**Dr. Chris Wilson**  
Chalmers, Gothenburg, Schweden

### **Probing Multiphoton Dressed States of a Superconducting Qubit**

There has been great interest in the new field of circuit QED, where the interaction of photons and matter is studied in the context of superconducting qubits. In this work, we create dressed states of a superconducting qubit, the single Cooper-pair box, with an intense microwave drive. The dressed states represent the hybridization of the qubit and photon degrees of freedom, and appear as avoided level crossings (ALC) in the combined qubit-photon energy diagram. The ALC occur when the energy of  $n=0,1,2, \dots$  photons is resonant with the charging energy of the SCB. By embedding the circuit in an rf resonator, we can directly probe the dressed states. On resonance, we see that the dressed qubit absorbs energy from the resonator. This allows us to measure the dressed gap of these states as a function of photon number and microwave amplitude, finding good agreement with theory. When the dressed states are off resonance, we see a purely reactive response, analogous to the quantum capacitance. For some conditions, we also see evidence of population inversion in the dressed states, as indicated by a negative quantum capacitance. These effects allow us to extract information about the complex relaxation in this nonequilibrium system.

*gezeichnet: Prof. Enrique Serrano, LMU*