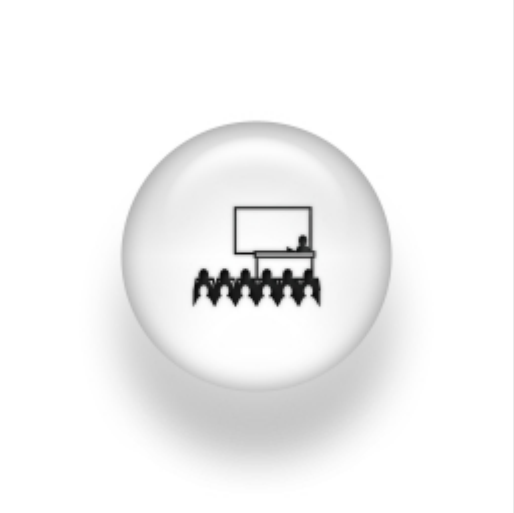
Superconducting molecular quantum dots

Wednesday, 5 May 2010, 12:00-13.00



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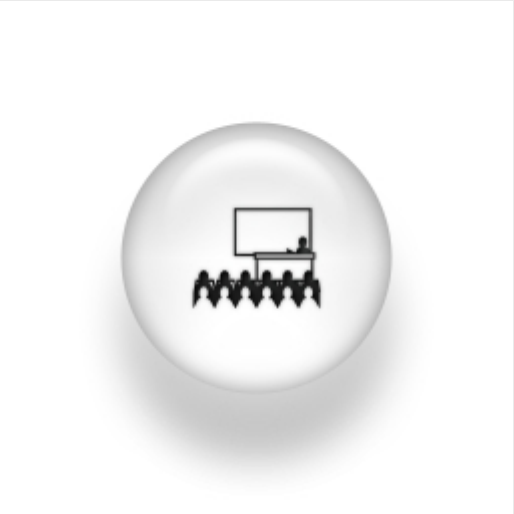
ABSTRACT:
The Josephson current through nanoscale quantum dots will be discussed in this talk, mainly from a theory point of view. The effects of electron-electron interactions, in particular the interplay of Kondo physics and superconductivity in spin-degenerate quantum dots and in carbon nanotube dots (where a larger SU(4) symmetry can be realized) are addressed. In systems with an internal degree of freedom, it is possible to modify this mode in a dissipationless manner through changes in the superconducting phase difference. This is shown for the case of a two-level system as model of a conformational degree of freedom. I will also discuss effects of spin-orbit coupling, which can induce a spontaneous breaking of time reversal symmetry, leading to an anomalous Josephson current.

Adiabatic pumping through quantum dots

Monday, 17 September 2007, 12:00-13.00



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A finite charge can be pumped through a mesoscopic system in the absence of an applied bias voltage by changing periodically in time some parameters of the system. If these parameters change slowly with respect to all internal time scales of the system, pumping is adiabatic.
The scope of this work is to investigate adiabatic pumping through a quantum dot, in particular the influence of Coulomb interaction between electrons in the dot on the pumped charge.
On one hand we develop a formalism based on Green's functions, in order to calculate the pumped charge from the weak-tunnel-coupling regime down to the Kondo regime. We extend our calculations to a system with a superconducting contact.
On the other hand we use a systematic perturbation expansion for the calculation of the pumped charge, giving us the possibility to analyze processes which contribute to charge pumping and to highlight the important role of interaction-induced level renormalization.