



École doctorale de Physique en Île de France

ED564

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COURS

MESOSCOPIC SUPERCONDUCTIVITY

Hugues POTHIER

SPEC, CEA-Saclay

Superconductivity at the mesoscopic scale has been an extremely active field of research in the last 25 years. I will review the phenomena that have been discovered, which help understanding superconductivity and allow fabricating new types of electronic devices. The following subjects will be treated:

- Small superconducting islands : when does the size become relevant ? Can the parity of the number of electrons be relevant?
- Superconductivity in conductors with a small number of transport channels: can a supercurrent flow through a single atom? What is the mesoscopic description of the Josephson effect?
- Proximity effect: how does superconductivity propagate into non-superconducting materials?
- Quantum circuits based on Josephson junctions: can one build artificial atoms out of superconductors? Which fundamental experiments does it allow to perform? What are the different kinds of superconducting quantum bits?

A large part of the course will be devoted to the description of experimental methods used for probing the transport properties of superconductors: circuits fabrication, measurements of current-voltage characteristics, of small supercurrent, of the local density of states, circuit quantum electrodynamics (c-QED) setups...

10 two-hours courses

at 3 p.m., on Wednesdays

From March 9th to May 25th (no course on April 20th and 27th)

Moyen Amphi, Laboratoire de Physique des Solides, bâtiment 510, Université Paris-Sud, ORSAY

Contacts : Hugues Pothier, hugues.pothier@cea.fr

Gilles Montambaux, directeur-adjoint de l'École Doctorale, gilles.montambaux@u-psud.fr

Inscription : Laura Ledez, gestionnaire de l'ED, laura.ledez@phys.ens.fr

EDPIF - ENS

Dépt de physique de l'ENS
24, rue Lhomond – 75005 Paris
Secrétariat : L. LEDEZ
+33 1 4432 2559
edpif.ens@edpif.org

EDPIF - UPMC

4, place Jussieu - 75005 Paris
Secrétariat : N. YASSINE
CC 921. Barre 56/66. Bur 218
+33 1 4427 8039
edpif.upmc@edpif.org

EDPIF - UPD

Bâtiment Condorcet, Bur 376A
10 r A.Domon et L. Duquet - Paris 13^e
Secrétariat: J. TAÏEB
+33 1 5727 6110
edpif.upd@edpif.org

EDPIF U-PSUD

LPS Orsay, Bât 510, porte 145
Univ Paris Sud - 91405 Orsay
Secrétariat: S. HOARAU
+33 1 6915 5356
edpif.u-psud@edpif.org