Les Séminaires de la Fondation
“Nanosciences aux limites de la Nanoélectronique”

Jeudi 27 mai 2010
à 16h

John R. Kirtley

Center for Probing the Nanoscale, Stanford University
Chaire d’Excellence de la Fondation Nanosciences

présentera un séminaire intitulé :

"Fundamental studies of superconductors using scanning magnetic imaging"

Vous êtes tous cordialement invités au pot qui suivra la présentation.

Amphithéâtre 15 de l’école PHELMA-Polygone
(anciennement ENSERG)
23 rue des Martyrs – 38000 Grenoble

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Fundamental studies of superconductors using scanning magnetic imaging

Although superconductivity is arguably one of the best understood phenomena in solid state physics, there is still much to learn. Despite nearly 25 years of effort, there is still no consensus on the mechanism producing the high critical temperatures in the cuprate perovskite superconductors. The heavy fermion superconductors have large carrier masses, strong interaction between spin and charge degrees of freedom, and potentially a wide variety of Cooper pairing symmetries. The non-cuprate perovskite superconductor Sr_2RuO_4 is believed to have a *p*-wave pairing state that breaks time reversal symmetry. Interest in unconventional superconductors has been reinvigorated with the discovery of iron-based compounds with high critical temperatures.

In this talk I will review some of the past and potential contributions of scanning magnetic imaging to our fundamental understanding of superconductivity.

For example, **scanning SQUID microscopy** (SSM) played a central role in the demonstration of $d_{x^2-y^2}$ pairing symmetry in the cuprate high-T_c superconductors. **Magnetic force microscopy** provides a means to measure the absolute value, temperature dependence, and spatial homogeneity of the superfluid density in superconductors, providing clues to their pairing symmetry. **Scanning SQUID susceptometry** images inhomogeneous superfluid density, including striking "stripes" in the pnictide superconductor $Ba(Fe_{1-x}Co_x)_2As_2$ (Ba-122), and reveals paramagnetic shielding just above the critical temperature in this material. Finally, **SQUID microscopy** reveals a novel "pairing" of superconducting vortices in Ba-122.

Biography

For the past dozen years John Kirtley has developed the technique of scanning SQUID microscopy and used the resulting novel instruments for fundamental studies. These studies included:

- Phase sensitive pairing symmetry tests
- Interlayer tunneling model
- Interacting p-loop arrays
- Quench cooled superconducting rings
- Angle-resolved phase sensitive measurements of the in-plane gap symmetry in YBa2Cu3O7

He previously worked in a broad range of other areas in condensed matter physics: scanning tunneling potentiometry; Josephson junctions; light emitting tunnel junctions; surface enhanced Raman scattering…

John Kirtley is a consulting Professor at Standford University and holds a Chair of Excellence at the Nanosciences Foundation since his project "**SUPER-NANO-CHARAC**" was selected in 2009.
Therefore this seminar will be an excellent opportunity to know more about his research interests and his scientific projects in Grenoble.

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