40 ans d'aventure scientifique et humaine

Le LAAS célèbre cette année 40 ans d'existence. Créé en 1968 comme unité propre de recherche du CNRS, le « Laboratoire d'automatique et de ses applications spatiales » s'est très vite développé, avec un parti pris d'anticipation, dans d'autres disciplines qui allaient profondément modifier la vie scientifique, et révolutionner jusqu'à notre vie quotidienne : l'informatique, les micro et maintenant nanotechnolgies, la robotique et l'intelligence artificielle. Sans changer d'acronyme tout en tenant compte des évolutions de ses thématiques de recherche, il deviendra en 1973 le « Laboratoire d'automatique et d'analyse des systèmes » puis en 1994 ce qu'il est aujourd'hui, le « Laboratoire d'analyse et d'architecture des systèmes ». Qu'en est-il aujourd'hui dans ces domaines qui connaissent une évolution si rapide ? Quels sont les apports croisés d'une discipline à l'autre ? Comment, fort des avancées d'hier et d'aujourd'hui, se dessine demain ? Des scientifiques talentueux et renommés dans leur domaine, que le LAAS est honoré d'inviter, apportent leur éclairage dans un cycle de conférences tout au long de l'année 2008.

Laboratoire d'Analyse
et d'Architecture
des Systèmes du CNRS

7, avenue du Colonel Roche - 31077 Toulouse Cedex 4 - France
Tél. +33 (0)5 61 33 62 00 - www.laas.fr

Cycle de conférences du LAAS-CNRS 40^{e} anniversaire

Toward Complex Nanosystems: Advances in Nanoelectromechanical Systems

par
Michael Roukes
Professor of Physics, Applied Physics, and Bioengineering
Co-Director, Kavli Nanoscience Institute
California Institute of Technology, Pasadena, USA.

Lundi 30 juin 2008 à 10h 30
LAAS-CNRS, salle de conférences

résumé

Nanoscale devices now allow us to envisage unprecedented measurements -- at the level of single cells and molecules, and at the level of single quanta. Among biological opportunities are: mapping the forces generated by living cells in real time, ultimately with piconewton-scale, single-molecule resolution; resolving, calorimetrically, the metabolism of individual cells in real time; and carrying out mass spectrometry at the level of individual molecules in real time. In the physical sciences, nanoelectromechanical systems offer the novel possibility of measurement and control at the level of individual mechanical quanta. I will give an overview of the state-of-the-art, future challenges, and some intriguing possibilities in these areas.

Transitioning nanoscale devices from the realm of “one-of-a-kind feats” into robust and reproducible nanosystems is a monumental challenge that transcends the capabilities of any one lab. Only the first steps have been taken towards this end. Two essential elements must be in place to realize the vast potential that awaits. First, an unfamiliar fusion of technologies is required; one that melds techniques from traditionally separate disciplines with the appropriate scale of approach. Second, robust methods for nanotechnological large-scale-integration are required, and these must engender routes to production en masse. The kind of disciplined assemblage of disparate technologies that is required is, perhaps, more familiar within the industrial sector than in academia. But it is now essential - whether for developing commercializable applications, or for pursuing fundamental research in medicine and the life and physical sciences. It is with scale-up - to systems-level complexity and production - that the real potential of active nanotechnology will be realized.

l'orateur

MICHAEL L. ROUKES is Professor of Physics, Applied Physics, and Bioengineering, at the California Institute of Technology. He is also Co-Director of both Caltech’s Kavli Nanoscience Institute and the global Alliance for Nanosystems VLSI with CEA/LETI-MINATEC.

Roukes received a Ph.D. in Physics from Cornell University in 1985, for research focusing upon electron transport in microstructures at ultralow temperatures under Nobel Laureate Robert C. Richardson. He then joined Bell Communications Research, as a Member of Technical Staff / Principal Investigator in the Quantum Structures Research Group where he carried out a series of pioneering experiments on the physics of ultrasmall semiconductor systems. In 1992, he became a tenured faculty member at Caltech where he built nanofabrication facilities and a large nanoscience research group now heavily involved in cross-disciplinary collaborations.

Roukes’ scientific interests range from fundamental and applied condensed matter physics to electrical engineering and biophysics – with a unifying theme centered upon development, application, and large-scale-integration of complex nanostructures. He has published and written extensively on nanoscience, and has lectured at most major research centers world-wide. With his group over the past two decades he has made a number of first discoveries and observations of fundamental physical phenomena at the micro- and nanoscale, including: NEMS-enabled zeptogram-scale mass measurements (Nano Letters, 2006), nanocalorimetry of attojoule/K heat capacities (Nano Letters, 2005), resisitivity of an individual domain wall (Nature, 2004), discovery of the giant planar Hall effect (PRL, 2002), measurement of the quantum of thermal conductance (Nature, 2000), invention of sub-single-charge nanomechanical electrometry (1997), discovery of chaotic dynamics in mesoscopic systems (PRL, 1991), invention of quantum “antidots” (BAPS, 1988), discovery of quenching of the Hall effect (PRL, 1987), and measurement of the phonon-electron bottleneck at ultralow temperatures (PRL, 1985).

Among his other professional activities, at Caltech Roukes was the Founding Director of the Kavli Nanoscience Institute (KNI) from 2004-06, co-founder and co-director of the Initiative in Computational Molecular Biology (CMB). Among his external activities, he chairs or serves on the advisory boards of a number of nanoscience centers and institutes worldwide, and is active on (and has organized) numerous national panels on nanotechnology. Since 1999, he has organized and chaired seven nanoscience conferences. Among his honors, Roukes is a Fellow of the American Physical Society, and was recently chosen as a Gilbreth Lecturer to the National Academy of Engineering.