



## NANOSCIENCE INSTRUMENT DEVELOPMENT DIVISION

Led by Dr. Gustavo Ceballos, the Nanoscience Instrument Development Division focuses on the design, development, improvement and deployment of advanced state-of-the-art instruments for nanoscience and nanotechnology. The main aim is the creation of an integrated scientific and technical platform with a highly qualified multidisciplinary team capable of addressing challenging instrumental projects both for basic nanoscience research as well as for nanotechnological applications. The Division acts as an active collaboration partner for ongoing experimental research efforts within the ICN and neighboring research institutions, developing new leading-edge instruments and techniques, and providing valuable support for the potential migration of developed scientific instruments to commercial-ready technological products.

### BACKGROUND

The development of scientific instruments is indispensable for scientific research. Over 70% of the Nobel Prizes in physics, chemistry, biology and medicine were achieved with the help of different kinds of advanced instruments. The advance of modern science and in particular nanotechnology will depend more and more on the development of scientific instruments. A common aspect of scientific instruments is that they were initially designed in response to very specific, narrowly defined requirements of research within a particular discipline; however following their successful development useful applications in other scientific fields became apparent. Similarly, scientific instruments designed to improve technical capability or to solve one set of research problems often turn out to have applications in disciplines and technology sectors far from those where they originated. The availability of new or improved instrumentation or experimental techniques arising from one academic discipline is a frequent cause of interdisciplinary collaboration.

### RESEARCH ACTIVITIES INCLUDE:

#### Collaboration with the major research lines of the ICN.

An important part of the Lab's instrumental developments is based on collaboration with the ongoing experimental research efforts within the ICN to resolve their problems via the development and application of new leading-edge instruments and techniques.

#### Collaboration with the Spanish Synchrotron Light Source (ALBA) and other neighboring research institutions.

A collaboration between the Atomic Ma-

nipulation and Spectroscopy Group of the ICN and the Spanish Synchrotron Radiation Facility ALBA has been already established, where the Nanoscience Instrument Development Division performs the design, construction and commissioning of a molecular beam epitaxy and Scanning Tunneling Microscopy facility for in-situ X-ray absorption studies. In the near future, the collaborative development of high-end instrumentation and setups will be extended to other experimental stations of ALBA and further research institutions.

#### Further instrumental development.

A significant effort is dedicated to the instrument development in the field of Scanning Probe Microscopies (SPM) and associated technologies, since they play a significant role in the development of science and technology in the nanoworld. It is anticipated that probe microscopes will overcome the current limits of microscopy and will become key tools for nanoscience and nanotechnology. The construction of complex structures, such as transistors, logical elements composed of atoms or molecules, or complete memory devices are envisaged.



**DR. GUSTAVO CEBALLOS**  
DIVISION LEADER

Dr. Gustavo Ceballos graduated in Chemistry at the Central University of Venezuela in 1989. He obtained his PhD at the Institut für Physikalische und Theoretische Chemie der Universität Bonn, Germany. In 1997 after his PhD he moved to the Institut für Experimentalphysik der Freie Universität Berlin for post-doctoral studies, and then from 2001 to 2002 to the Low Temperature Scanning Tunneling Microscopy Group at the Fritz-Haber-Institut der Max-Planck-Gesellschaft also in Berlin. From 2002 to 2006 he was research scientist in the XSTM and Low-temperature STM of nanostructures division at the Laboratorio Nazionale TASC-INFN, Trieste, Italy. Along his scientific career with the aim of addressing new scientific experiments and investigations he was frequently confronted with the need of developing or modifying instruments or experimental setups. In 2006 he obtained a senior scientist position at the Catalan Institute of Nanotechnology (ICN) in Barcelona, Spain. He started the creation of the Nanoscience Instrument Development Division, an integrated scientific and technical platform to address challenging instrumental projects both for basic nanoscience research as well as for nanotechnology applications. He also actively participates in the scientific activity of the Atomic Manipulation and Spectroscopy Group of the ICN.

