RESEARCH ACTIVITIES

DIPC is dedicated to two main areas of research.

Condensed Matter Physics

Research at the Condensed Matter Physics group is currently focused into the structural, electronic and optical properties of solids, surfaces and low-dimensional systems. Particular attention is paid to systems of nanometer size. Together with the theoretical activity, in which most of the research is focused, experimental work based on scanning tunnelling microscopy (STM) and photoemission techniques is developed in the nanophysics laboratory. In general, the group concentrates on the following areas of research:

- **Structural and electronic properties** of materials using first-principles methodologies. Among other systems, bulk materials, surfaces, metal clusters, molecules of biological interest, and nanowires, have been recent targets of study.
- **Electron dynamics** in solids, surfaces, adsorbates, and low-dimensional systems, with particular emphasis on ultrafast processes and size effects.
- **Theoretical and experimental analysis** of tunnelling topography and spectroscopy in nanostructures.
- **Interaction of charges and radiation** with surfaces and nanostructures: nanophotonics, theory of photoemission and ion-solid interactions, and electron microscopy.

Polymers and Non-crystalline Materials

The current activities in this area are focussed on the general line: Structure and Dynamics of polymer materials and glass-forming systems. This is mainly an experimental approach by combining different techniques, in particular, neutron scattering, broadband dielectric spectroscopy and nuclear magnetic resonance. Moreover, we are also developing atomistic molecular dynamics simulations of polymer systems and coarse-grained methods as well. Within this general area, we can identify the following recent topics of research:

- Dynamics of nanocomposites and multicomponent polymer materials.
- Development of simulation methods in polymers.
- Dynamics of glass-forming polymers and the problem of the Glass Transition.
- Molecular rheology of branched polymers.
- Water-polymer interactions: a new route to approach water behaviour in biological systems.
- Confinement effects in polymer blends and multicomponent systems.
- Relationship between transport properties and molecular mobility in polymeric membranes.