Universidad Carlos III de Madrid

Seminario del Instituto Gregorio Millán

Coupled phenomena and quantum-continuum coupling in modeling low dimensional nanostructures

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Abstract

Low-dimensional semiconductor nanostructures (LDSNs) are challenging objects to study from both, fundamental physics and mathematical points of view. These objects are receiving increasing attention as key components of many optoelectronic devices. Quantum dots (QDs), LDSNs in which the motion of electrons is confined from all three spatial dimensions, can also be used as biological tags in DNA analysis, as well as in other bio-technological applications, while the idea of using a spin confined to a QD as a qubit promises imminent breakthrough in quantum information processing. The number of practical applications of LDSNs continues to grow which requires the development of adequate mathematical models for their description and efficient numerical approximations.

Despite a wide range of current and potential applications, properties of LDSNs, and QDs in particular, are still frequently analyzed with simplified mathematical models, incapable to account correctly for many effects that are coming from other than quantum mechanical scales (e.g., strain, piezoelectric, thermal and other important effects). In this talk, our main emphasis will be on the mathematical models where the coupling between quantum and continuum mechanics parts is essential. A number of numerical examples will be given to illustrate the theory.

If time permits, we will also discuss new analytical and numerical modelling techniques to control single electron spin states adiabatically through the application of the geometric Berry phase.

Día y hora: Martes, 8 de noviembre de 2011 a las 12:30 horas
Lugar: Sala 2.3.B02 (Edificio Sabatini), Universidad Carlos III