



量子材料科学中心

International Center for Quantum Materials

Seminar

“Pressure Induced Complexity even in Simple Systems: Li and Ca.”

Prof. Aitor Bergara

Condensed Matter Physics Department,
University of the Basque Country, Spain



- **Time: 4:00pm, Aug. 25, 2011 (Thursday)**
- **时间: 2011年8月25日 (周四) 下午4:00**
- **Venue: Room 607, Conference Room A, No.5 Science Building**
- **地点: 理科五号楼607会议室**

Abstract

At ambient conditions, simple alkalis or alkaline earth elements behave as free-electron metals and adopt highly symmetric close-packed structures. According to the standard view, under pressure simple metals should even become more free-electron-like. However, recent results reinforce the idea that their electronic density becomes quite complex under pressure. The emergence of an increasing inhomogeneous and anisotropic electronic density is related to the fact that, under pressure, valence electrons localize at the interstitial sites making the electrons hybridize, and this is directly reflected in their band structure. Indeed, some bands are flattened, other softened and, in general, it is difficult to predict what the evolution of the band structure will be under compression. With respect to the dynamical properties, it has been made clear that pressure not necessarily hardens the phonons. Actually, in many cases some phonons soften, which might induce instabilities to appear and drive phase transitions to a series of complex structures of lower symmetry, along with significant changes of their physical properties. Interestingly, soft phonons turn out to be very important under pressure, as they are those that most strongly contribute to the electron-phonon coupling constant, and therefore, the superconducting transition temperature is normally enhanced under pressure. Associated to this phonon softening, anharmonicity might also become critical under pressure. For example, the role of anharmonicity is crucial to stabilize the simple cubic phase of calcium, which under pressure becomes a quantum anharmonic solid.

About the Speaker

Aitor Bergara got the PhD in physics in 1998 from the University of the Basque Country (Spain). Currently he is Associate Professor at the Condensed Matter Physics Department at the University of the Basque Country. He is also a member (associate scientist) of the *Donostia International Physics Center* and the *Material Physics Center* from the Spanish National Research Council. Aitor Bergara has 51 publications in refereed journals, has participated in 19 funded research projects, and supervised 4 thesis. He got the outstanding undergraduate and PhD student awards from the University of the Basque Country. In 1999-2001 he became a *Fulbright Postdoctoral Fellow* at the *Laboratory of Atomic and Solid State Physics* at Cornell University (USA) to work in the group of Prof. N.W. Ashcroft. Recently, he has been appointed Prof. Tang Ao-Qing visiting professor at Jilin University (China).