Università di Roma Tor Vergata

Materials Science Seminar
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Paoluzzi room
Sogene Building

How do atomic defects affect the electronic properties of superconductors?

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The remarkable physical properties of Fe-based superconductors give us the possibility to study with great sensitivity how atomic-scale defects affect bulk electronic properties, a topic that is of general interest in materials science. Additionally, in the case of superconductors, this topic provides relevant information to understand the connection between the nature and concentration of atomic defects with the critical temperature up to which the material can present zero resistance. In the family of Fe-based superconductors, the FeSe compound has captured the attention of the scientific community due to its simple crystal structure composed of a stacking of Fe planes with Se atoms slightly displaced up and down. Despite this simplicity in the crystal structure, the electronic properties of Fe-based superconductors are strongly affected by deformations of the crystalline structure introduced by doping or application of pressure. In this talk I will present experimental results that allowed us to elucidate that dumbbell-type atomic defects, directly imaged with scanning tunnelling microscopy, alter the spectrum of core electronic levels in the volume of the samples. Using density functional theory simulations we show the good quantitative agreement between the modification of the electronic clouds of the atoms in the environment of these defects and the spectral shape of the electronic core levels in these compounds. Additionally, I will discuss how dumbbell-type defects can produce a dramatic deterioration of superconductivity when these defects proliferate.