CNR**NANO**
ISTITUTO NANOSCIENZE CONSIGLIO NAZIONALE DELLE RICERCHE

Seminar Series

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CNR NANO NEST, Pisa

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"Building and probing functional structures at semiconductor surfaces by cryogenic scanning tunneling microscopy"

In the ultimate miniaturization limit of surface-supported functional structures the building blocks are given by single atoms or molecules bound to the semiconductor template, exhibiting a specific state of charge, electronic state density, and spin to be coupled to the environment. Scanning tunneling microscopy (STM) at cryogenic temperatures opens up the possibility to place single atoms and molecules at selected positions at a surface. As yet, STM-based manipulation has been achieved mainly on metal substrate surfaces. This talk describes the extension of atom manipulation to III-V semiconductor materials and demonstrates the controlled repositioning of native In adatoms on a InAs(111)A-(2×2) surface. Applying this technique in combination with scanning tunneling spectroscopy, we find that assembled In adatom chains (interatomic spacing 8.57 Å) exhibit confined quantum states implying substantial interatomic electronic coupling [1]. Moreover, it is revealed that native In atoms in the surface layer become bistable in vertical height when a nanostructure is assembled nearby [2]. The binary (reversible) switching of surface atoms, driven by the STM tip, changes their charge state. Coupling between these switching units via electrostatic interaction is facilitated by assembling extended adatom chains, allowing us to explore the emergence of complex multiple switching at the atomic scale.

[1] S. Fölsch, J. Yang, Ch. Nacci, K. Kanisawa, Phys. Rev. Lett. **103**, 096104 (2009)
[2] J. Yang, S. C. Erwin, K. Kanisawa, Ch. Nacci, S. Fölsch, Nano Lett. **11**, 2486 (2011)

The seminar will be transmitted by videoconference to all NANO Centers.

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