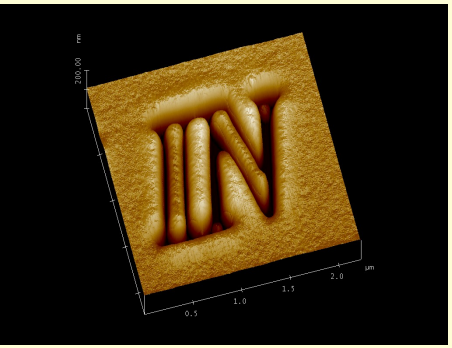
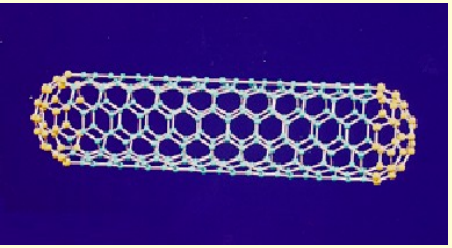
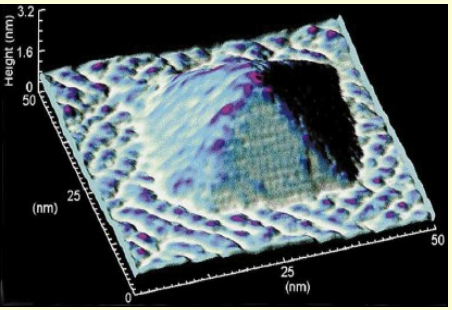
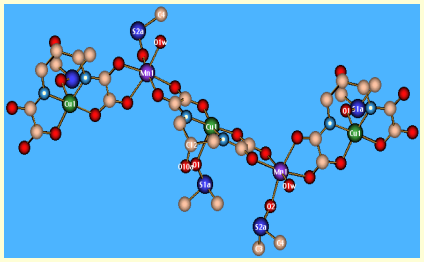








Institute of Nanoscience

Millenium Science Initiative - PADCT/CNPq

nano@fisica.ufmg.br

64 researchers from 13 Institutions

UFMG, UFJF, UFV, UFSJ, CDTN, CETEC-MG, UFRJ, UFF, UERJ, PUC-Rio, LNLS, UFBA, UFSE

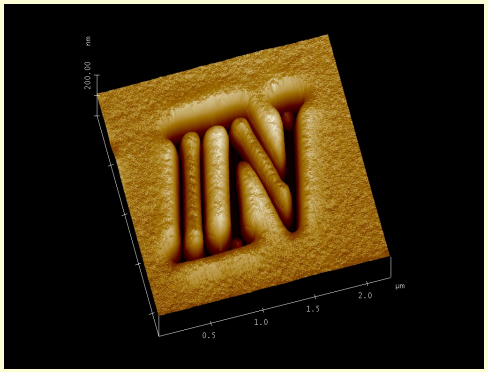
1- Carbon nanotubes and related systems

2- Nanostructures of magnetic materials

3- Biological and organic/inorganic nanosystems

4- Nanostructured semiconductors

Scientific Committee



Coordinators

Alaor S. Chaves (UFMG)

Marcos A. Pimenta (UFMG)

Area Coordinators

1- **Hélio Chacham** (UFMG)

(Carbon nanotubes and related systems)

2- **José d'Albuquerque e Castro** (UFRJ)

(Magnetic nanostructures)

3- **Oscar N. Mesquita** (UFMG)

(Biological, organic/inorganic)

4- **Belita Koiller (**UFRJ**)**

(Nanostructured semiconductors)

Goals of the Institute

- To advance the understanding of the physical and chemical properties of nanostructured systems and to develop new systems
- To strengthen the interaction between the researchers of the Institute, including their collaborators in Brazil and abroad
- To promote the practice of shared use of laboratories and other research facilities
- To foster the development of emerging research centers in nanoscience in Brazil
- To train new highly qualified researchers and prepare them for collaboration in interdisciplinary research

Main Scientific and Technical Achievements

1 – Production of carbon nanotubes, fullerenes and endofullerenes

2 – Important advances in the optical properties of single nanotubes

3 – Begining fabrication of FET based on carbon nanotubes

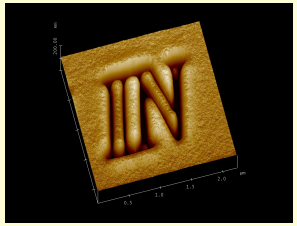
4 – Photoluminescence measurements of carbon nanotubes wrapped on DNA

5 – Production of magnetic nanoparticle systems

6 – Production of metallic thin films by molecular beam epitaxy (MBE)

7 – Production of self-assembled semiconductor quantum dots by MBE

8 – Production of molecular nanomagnets



9 – Production of polymeric blend films

10 – Production of thin films of conjugated polymers containing metal nanoparticles for laser aplications

11 – Expertise on litographic nanofabrication

12 – Several theoretical and and some experimental advances on spintronics

13 – Several theoretical advances on magnetic properties of nonostructured systems

14 – Use of optical tweezers to manipulate single DNA molecules and other biological systems

15 – Develpment of defocusing microscopy to investigate biological systems

Impact of the project on available infrastructure

- Maintenance of the already existent research infrastructure of the group, estimated in US$ 10 million.

- Aquisition of new equipments for the investigation of nanosystems. The most important ones are:

Scanning probe microsocopes

SQUID (for measuring magnetic momenta and susceptibilities)

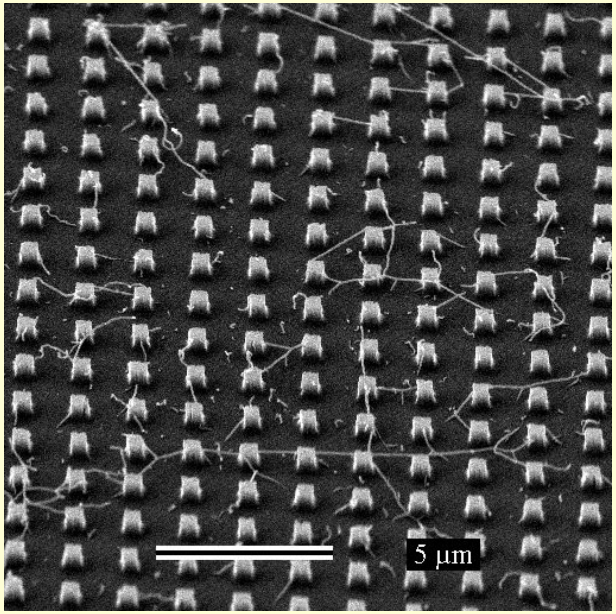
Reactive ion etching system (for controlled corrosion with nanometric precision),

CVD system for carbon nanotube synthesis,

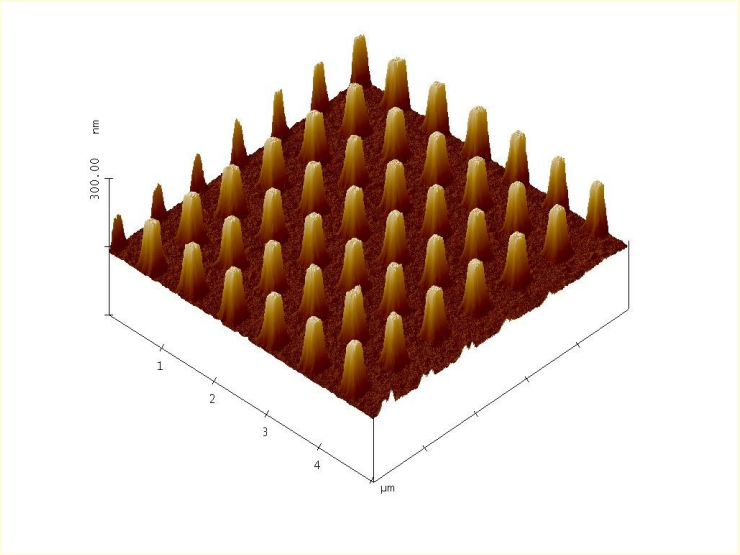
FTIR system used in the fabrication process of infrared photodetectors.

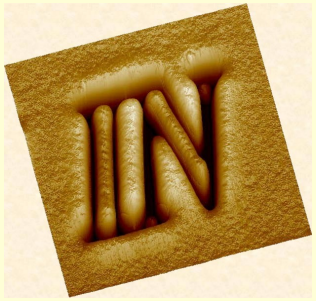
Tunable laser (for resonant Raman spectrocopy)

CVD system for growing carbon nanotubes

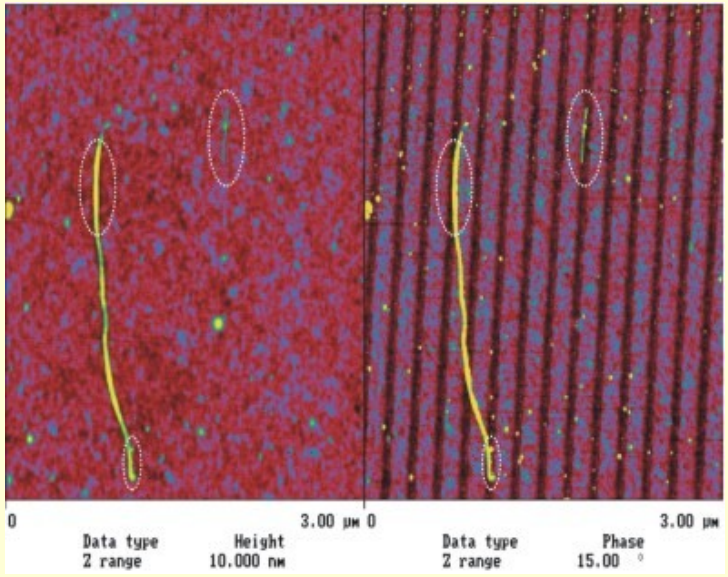


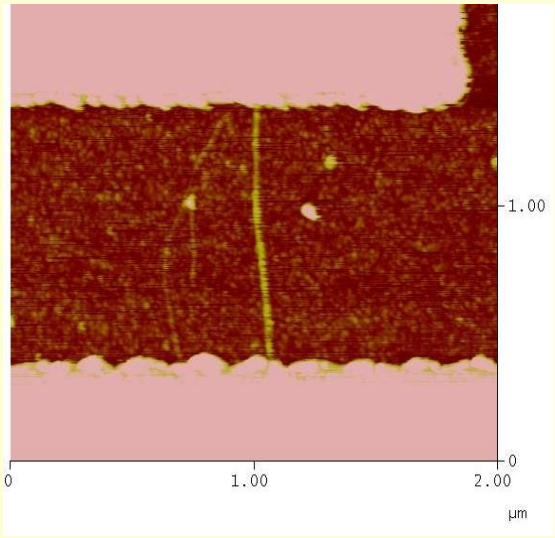
RIE system for high definition corrosion

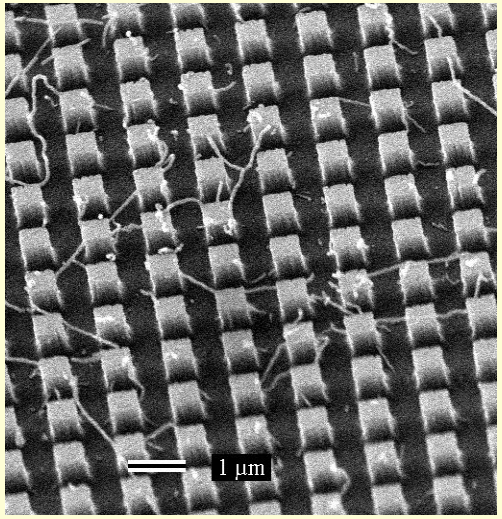




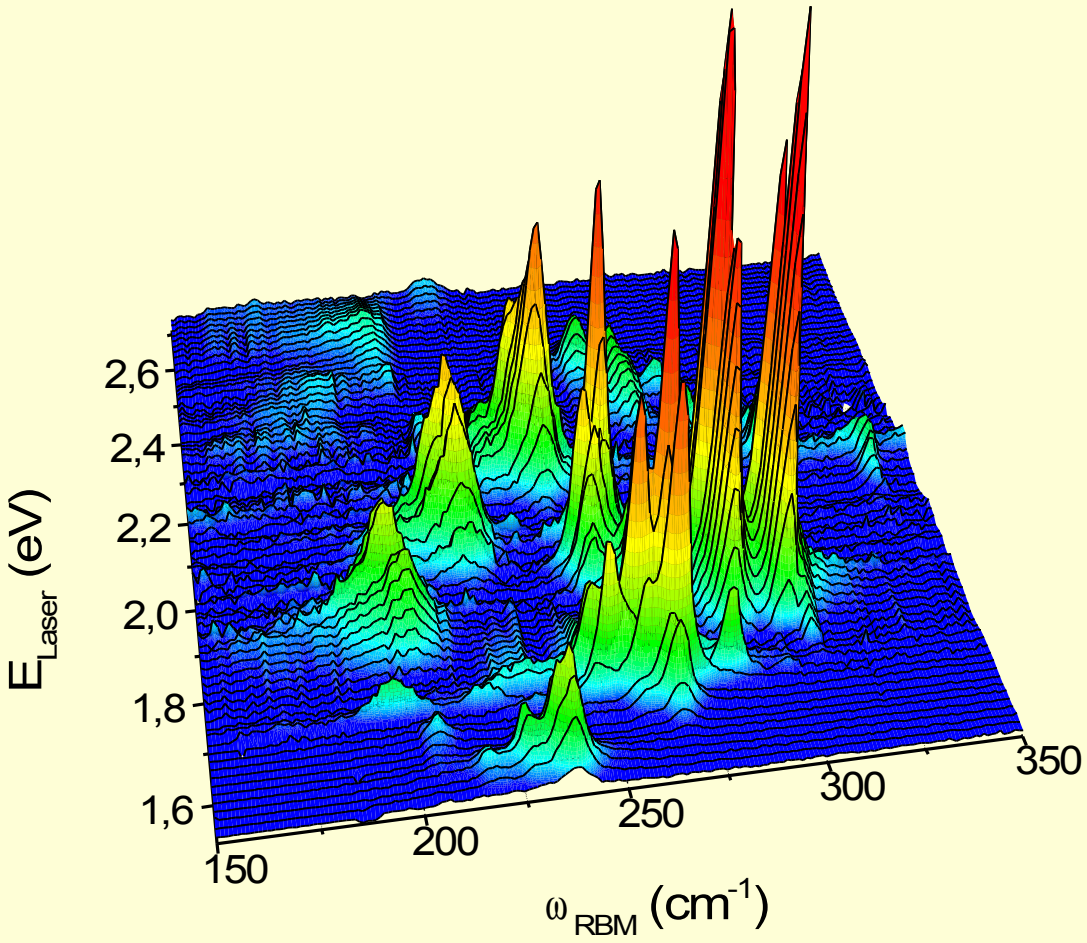
Carbon Nanotubes

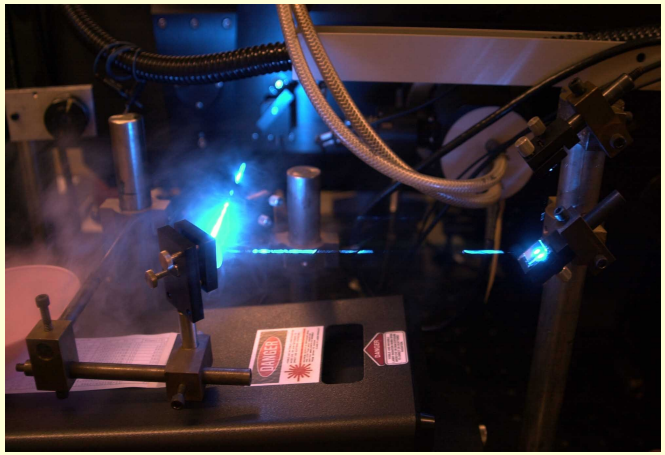






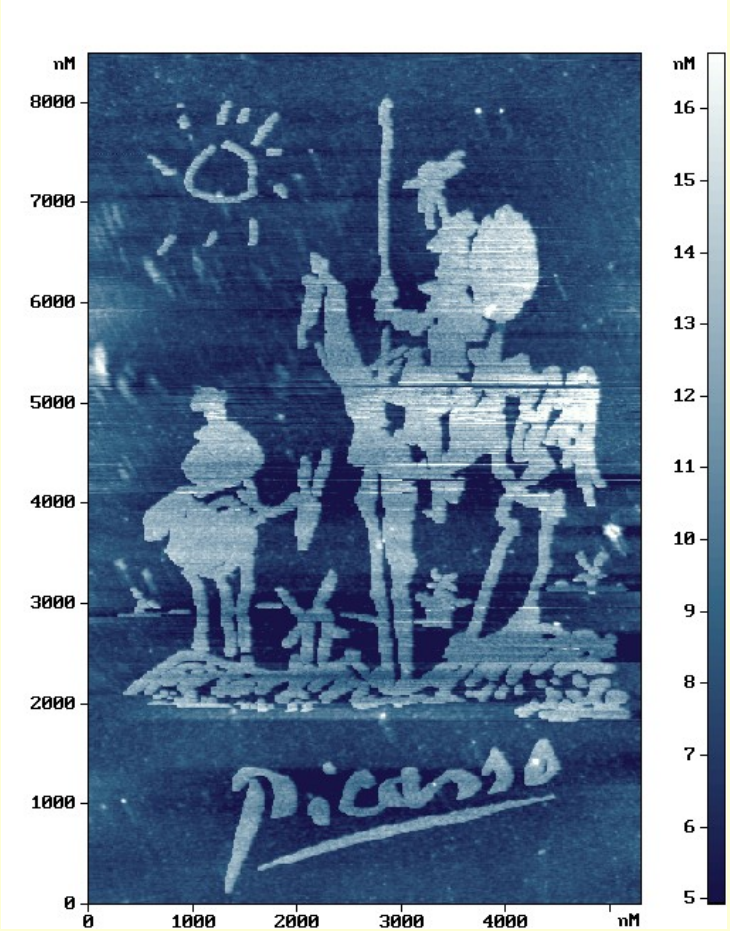
Ressonant Raman scattering by carbon nanotubes dissolved in watter





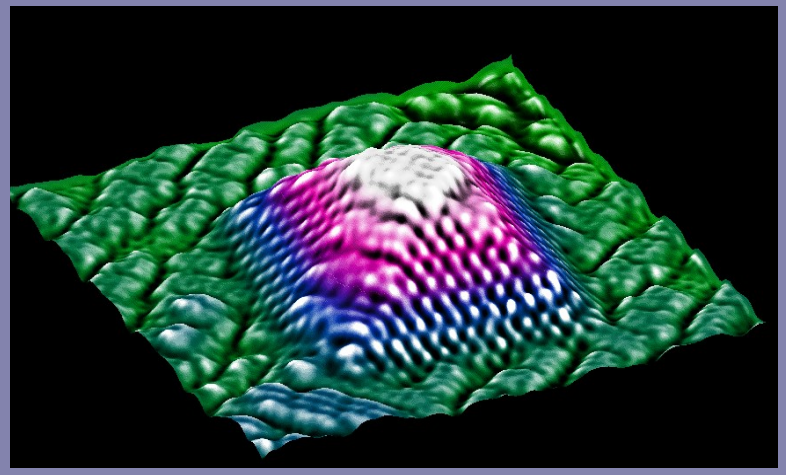
Scanning probe microscopes

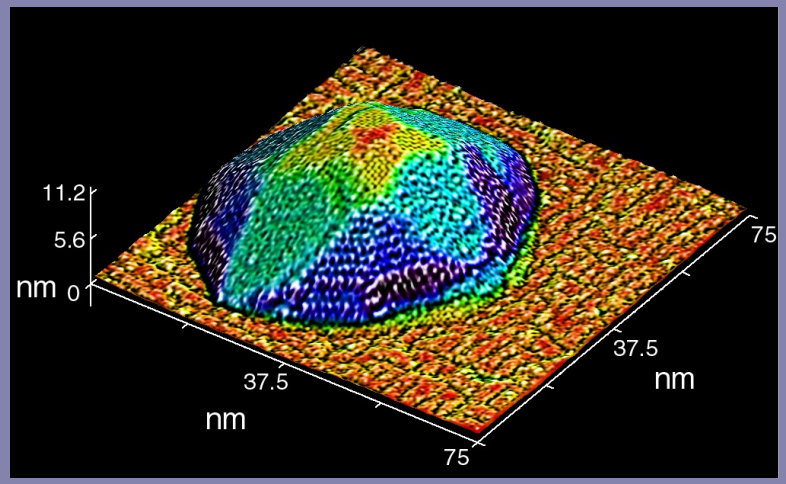
Picasso in five microns

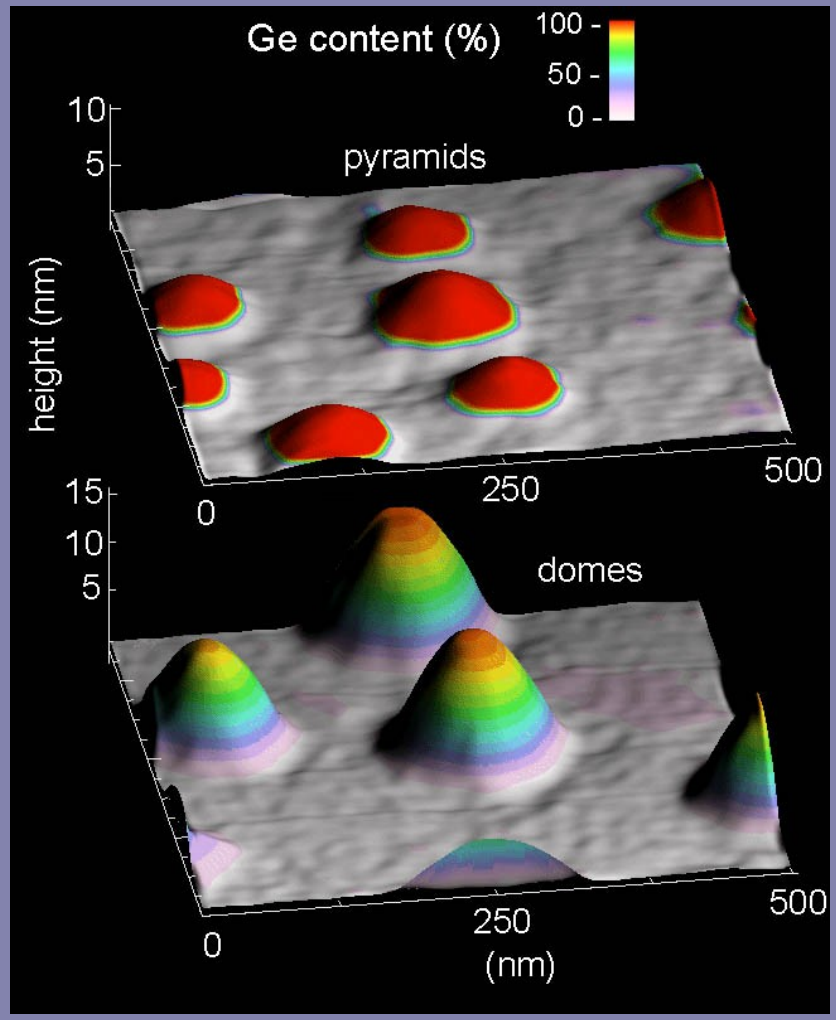


Nanolithography by SPM

Self-assembled semiconductor quantum dots

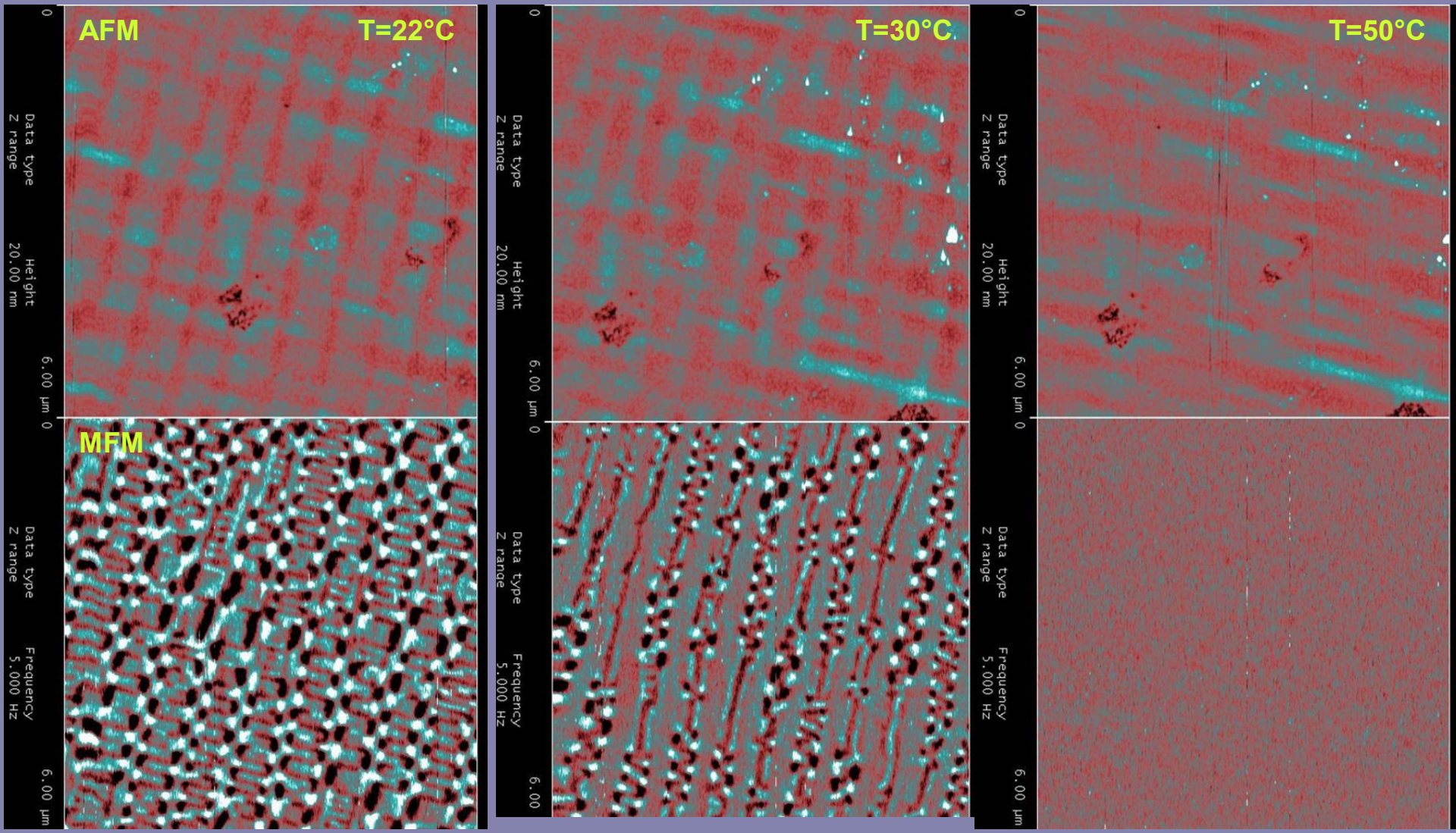






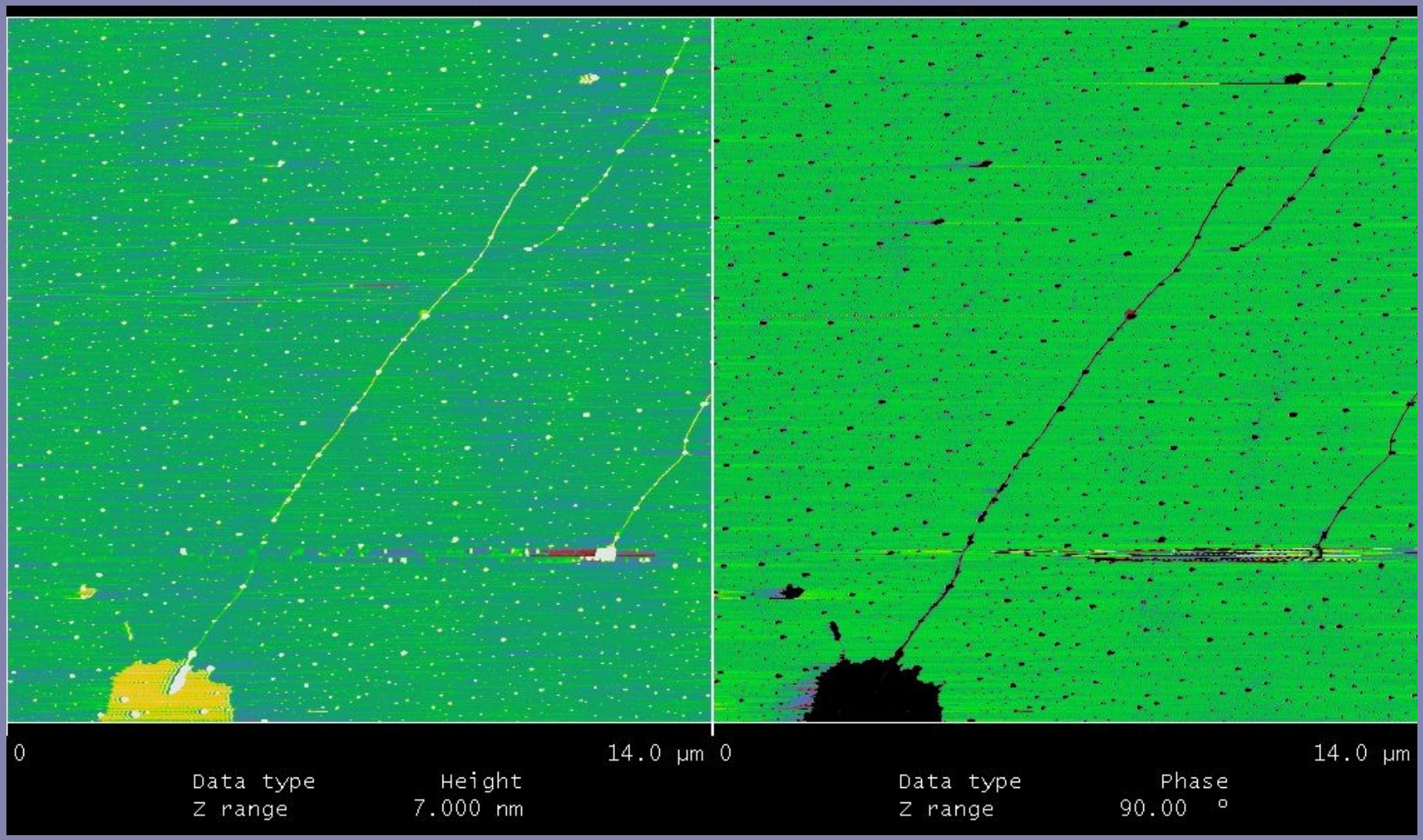
Islands of de Ge on Si

Magnetic semiconductors



MnAs film over GaAs

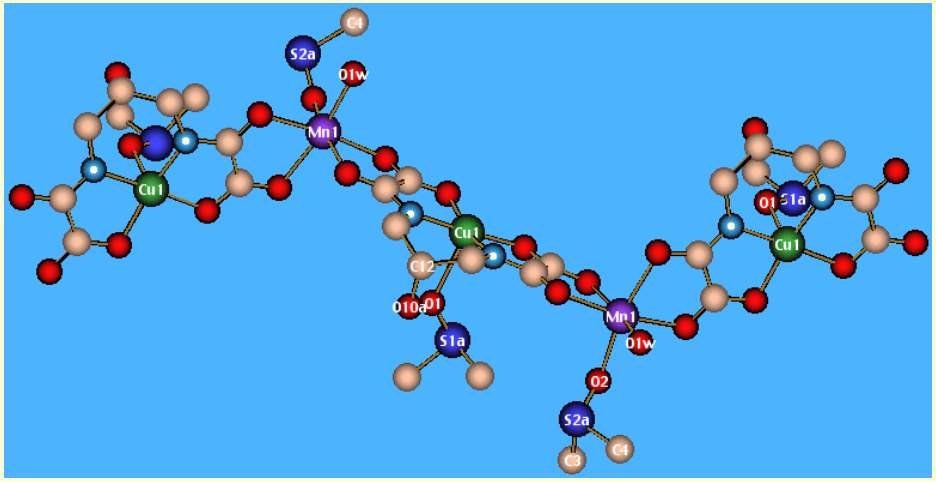
Gold nanowires using DNA as a template

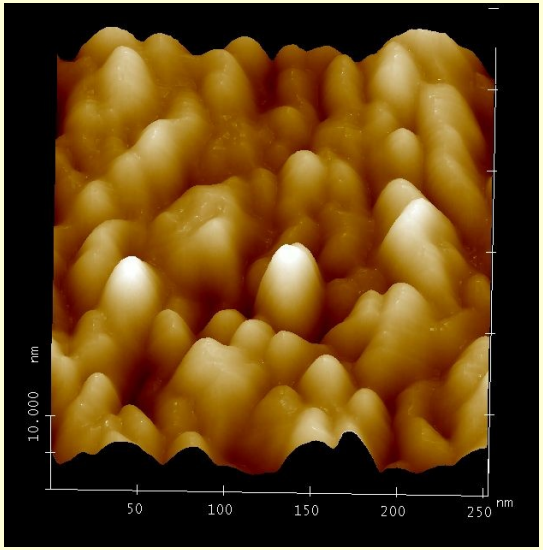


Optical tweezer and defocusing microscopy used to see phagocytosis

SQUID Magnetometer

Molecular magnets





Main strategies to disseminate results to a broader audience

- More than 300 papers were published in ISI indexed journals, including 1 in Science, 20 in Physical Review Letters, 78 in Physical Review, 10 in Applied Physics Letters and 3 in Europhysics Letters
- More than 500 works presented in International and National Conferences.
- The members of the project presented 20 invited talks in International Conferences.
- Seminars for general public in order to disseminate Nanocience & Nanotechnology (a book: *From the Transistor to Nanotechnology*)
- Three annual Meetings of the Institute for main researchers, collaborators, post-docs, graduate students and undergraduate students involved in the project.

Impact on the strengthening of the involved institutions

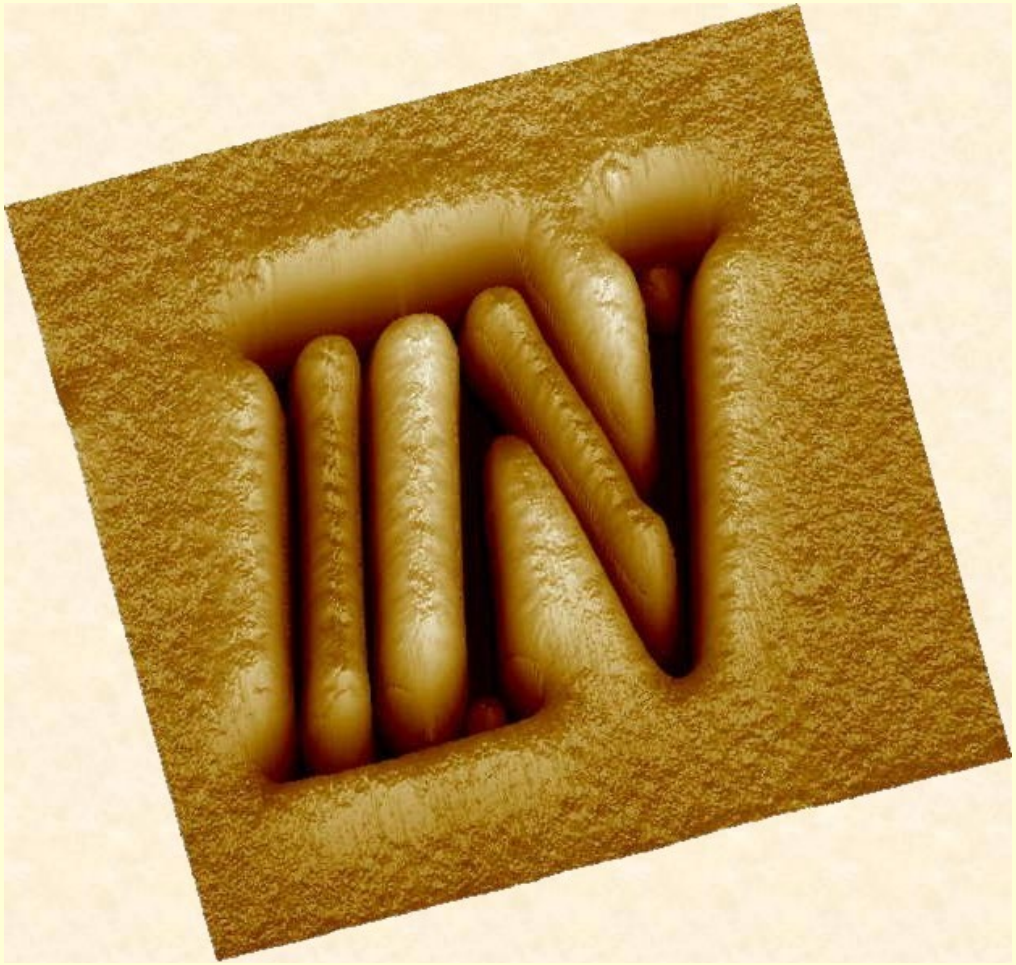
- Shared use of the equipments by members of the Institute
- Missions and visits to improve scientific collaboration between members of the Institute
- Interdisciplinary cooperation between Institute members involving physics, chemistry and material sciences.

Enhancement of national and international S&T cooperation

- Scientific collaboration of the members of the Institute with more than 50 different groups in Europe, United States, Latin America and Japan.
- Collaboration with other Millenium Institutes in Brazil (Quantum Information Institute) and in Chile (Nucleo Milénio Fisica de la Materia Condensada).
- ICPS 2008 to be organized in Brazil

2 microns
overall size

Can now be
Produced in
0.7 micron

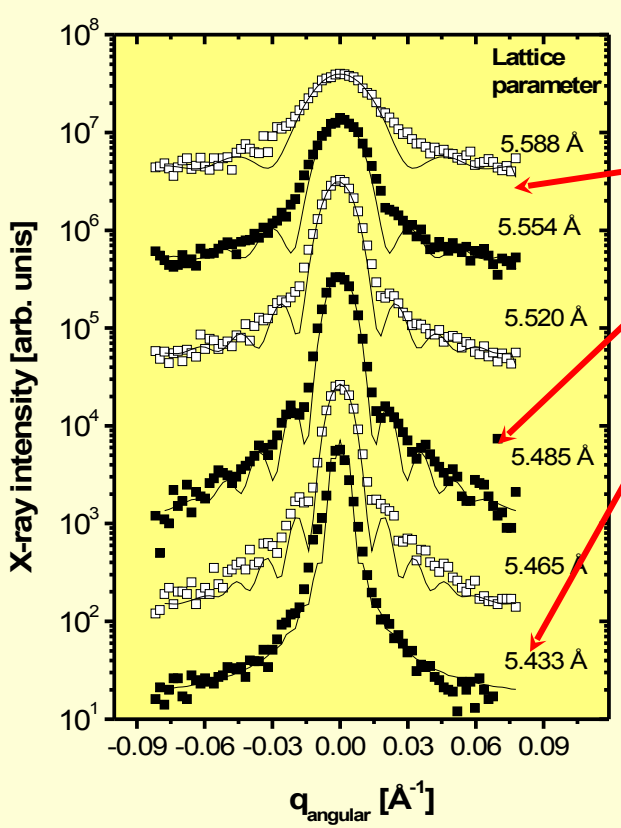


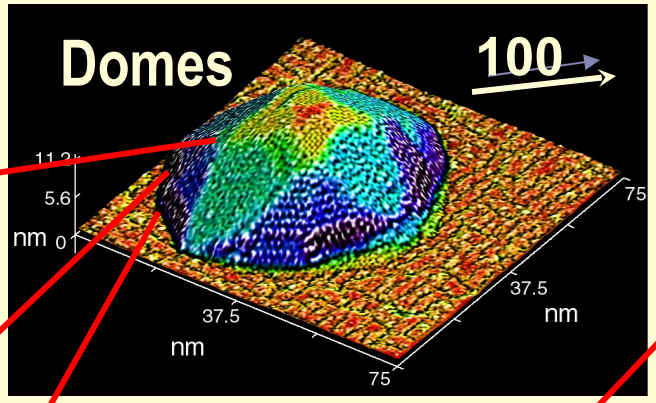
Institute of Nanoscience

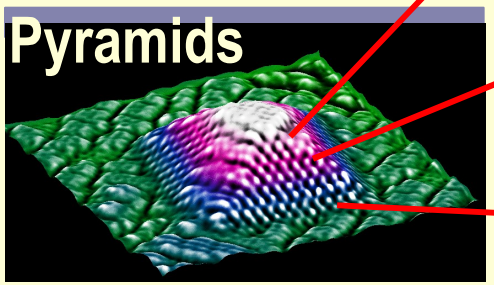
Millenium Science Initiative - PADCT/CNPq

X-ray scattering from sections of a coherent Ge/Si island

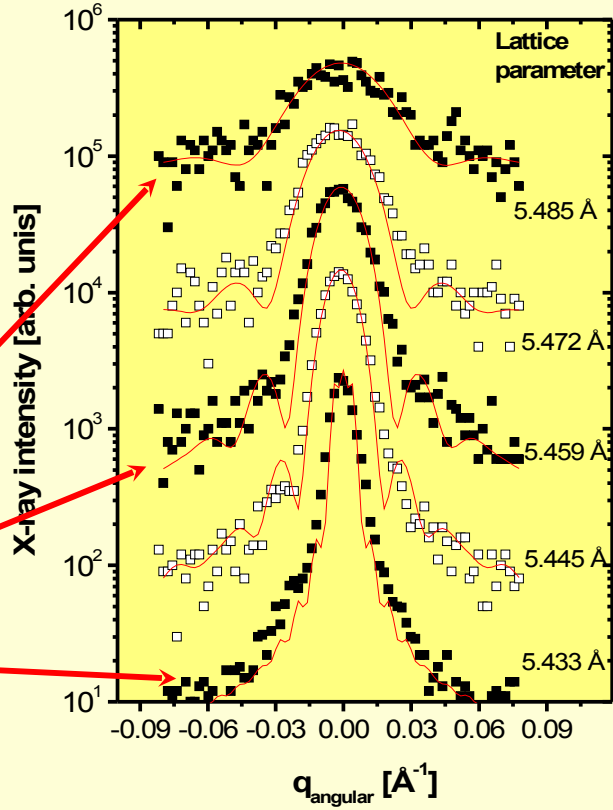
LNLS - UFMG







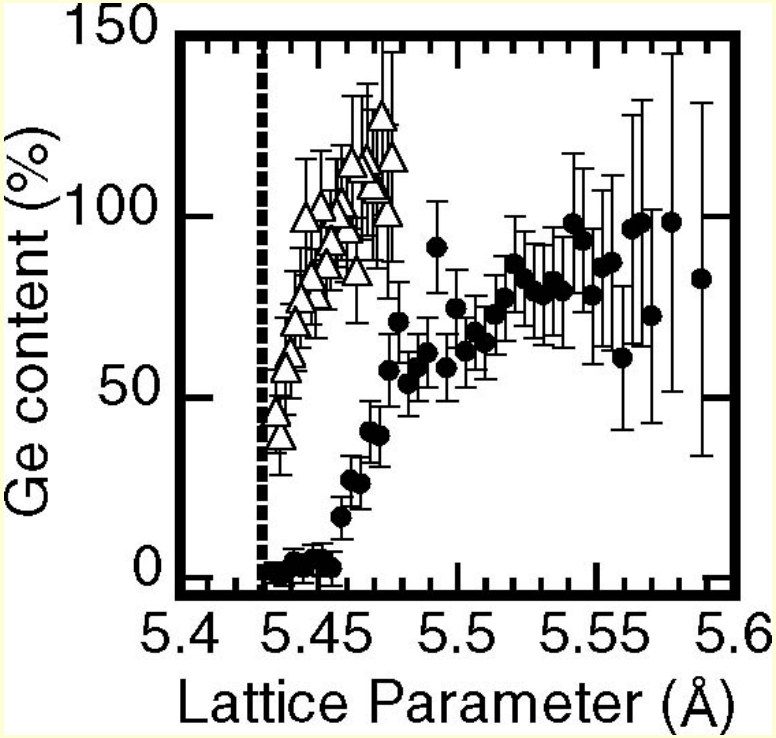
100



X - ray scattered intensity from an island of side L

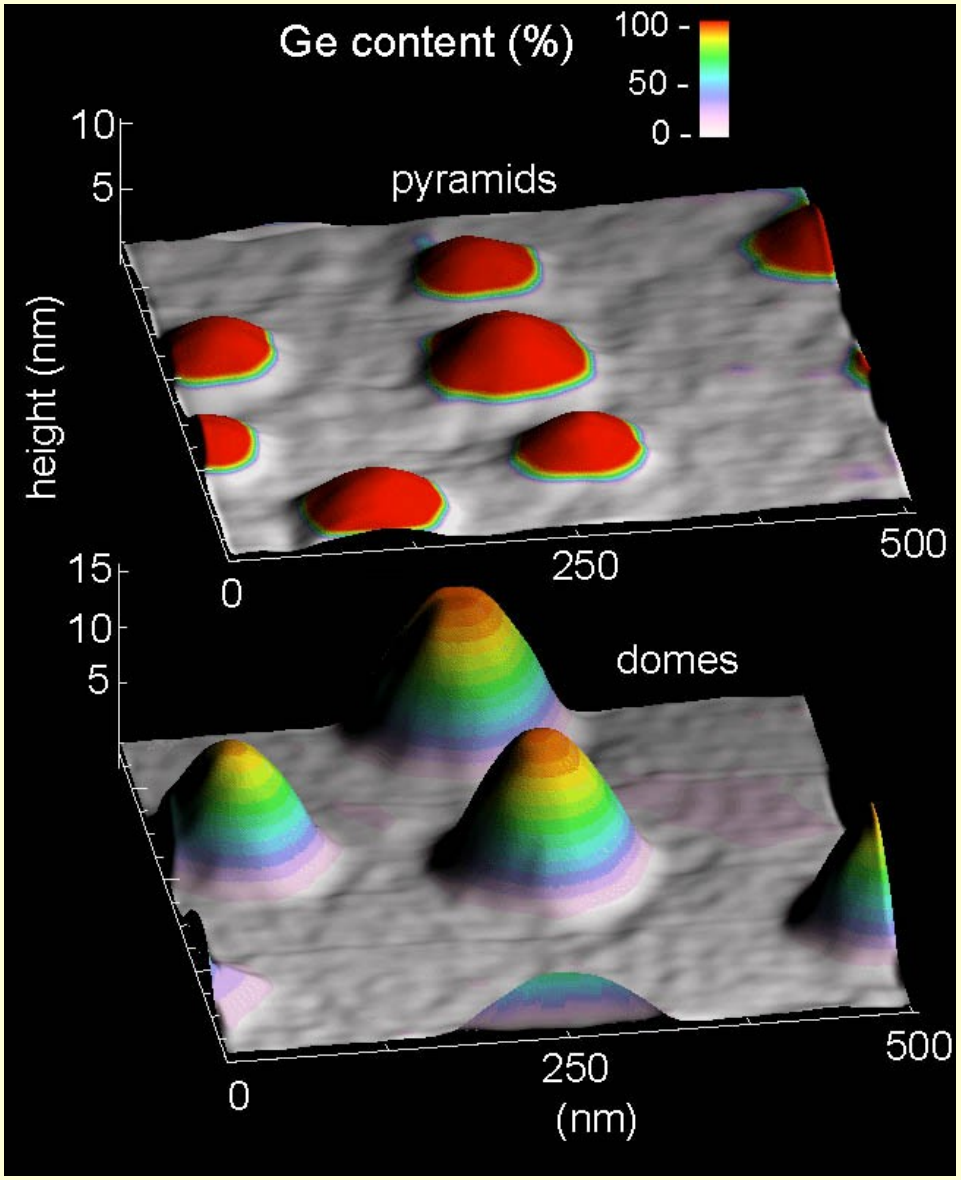
$$I(\mathbf{q}_a) = \left(\frac{\sin(q_a L)}{q_a L} \right)^2$$

Lattice constant x Ge concentration relationship

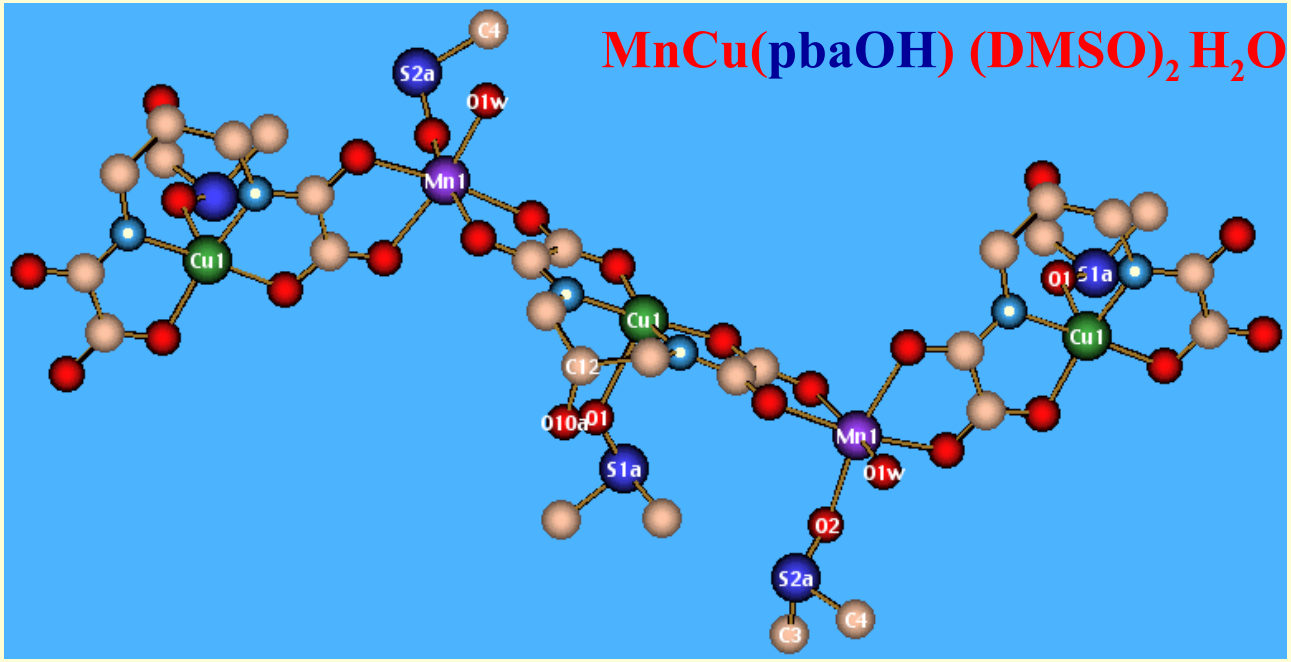


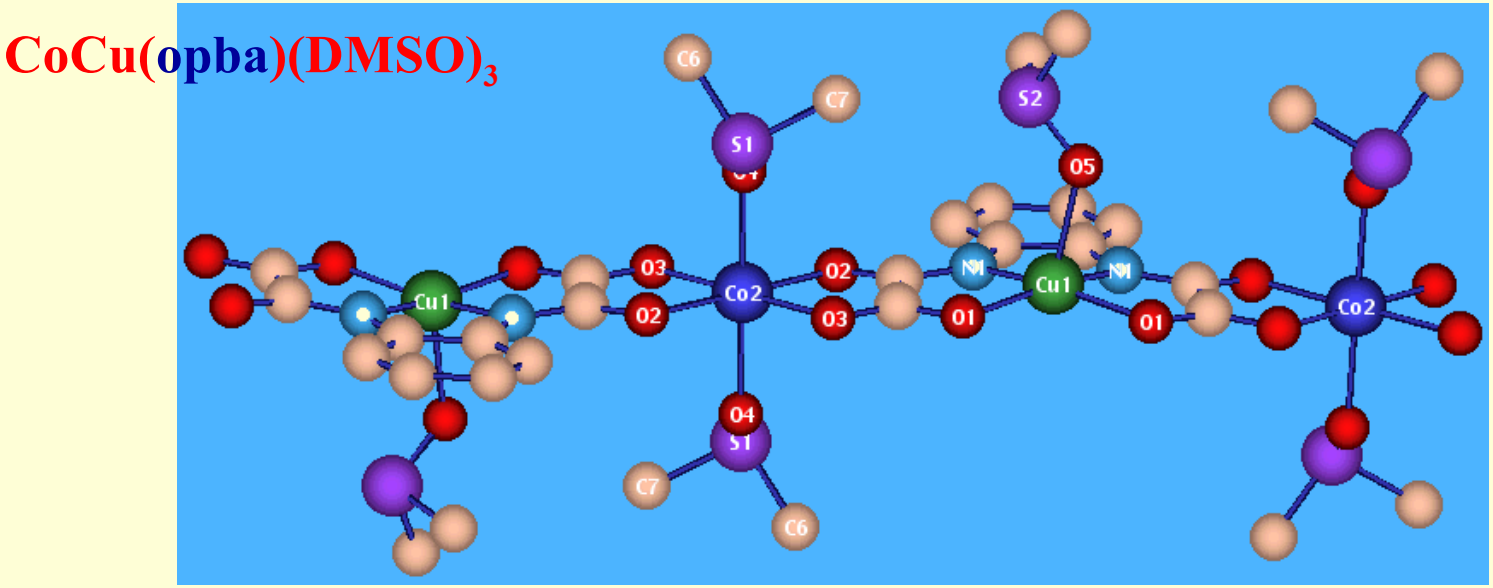
Pyramids

Domes



NEW CHAINS

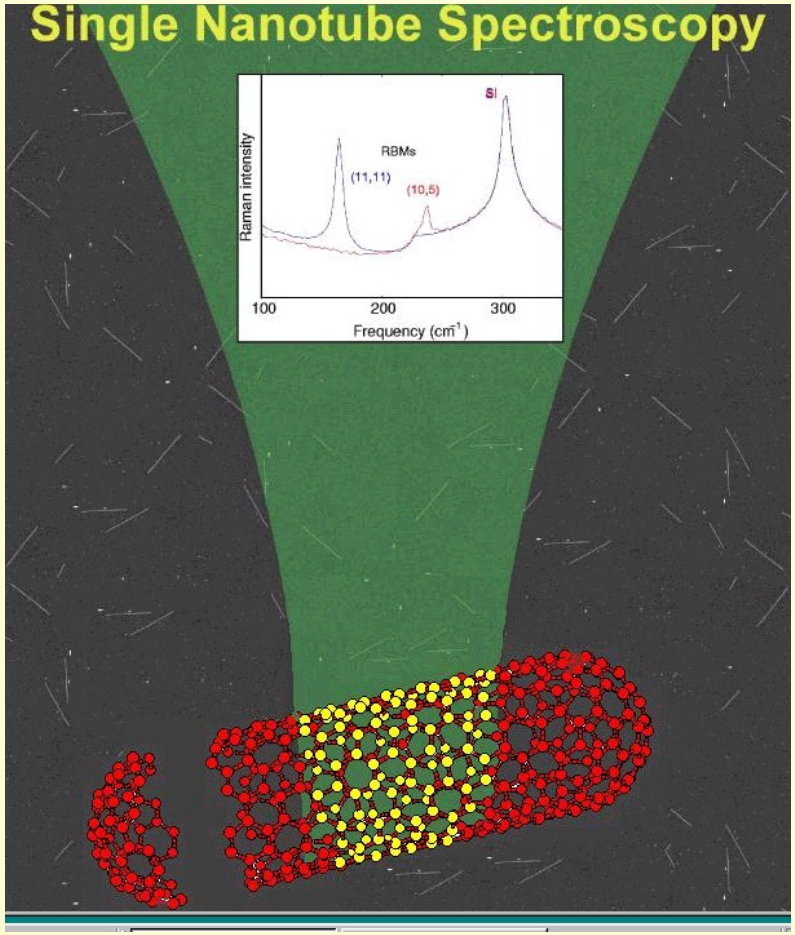

MnCu(pbaOH) (DMSO)2 H2O
C4
S2a
O1w
Mn1
Cu1
C12
O10a
O1
S1a
O2
C3

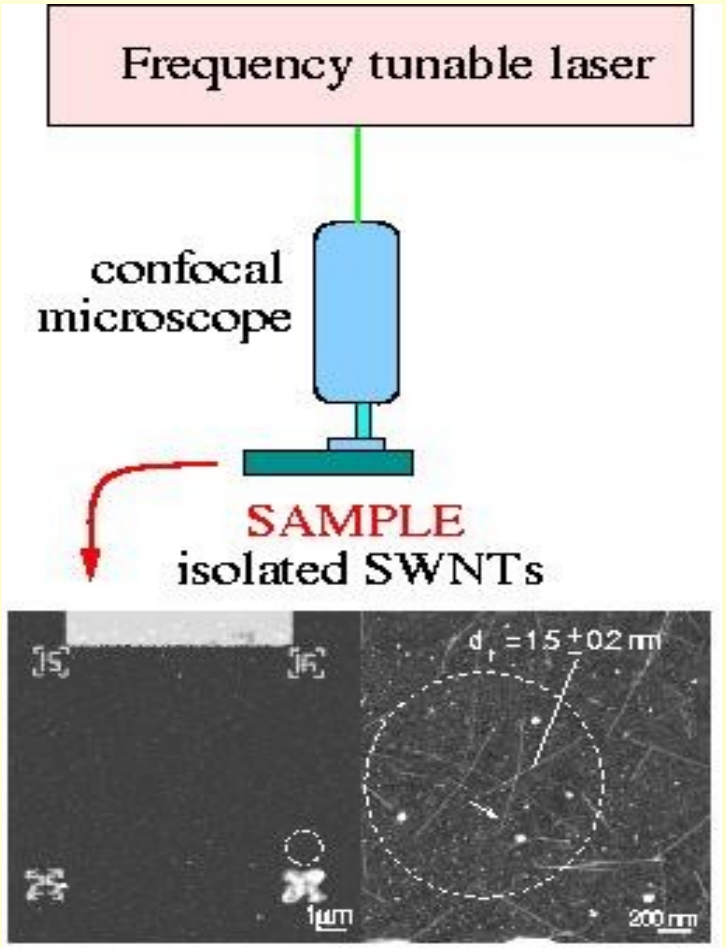

CoCu(opba)(DMSO)3
C6
C7
S1
S2
O5
O3
O2
Co2
Cu1
O1
O4

Single Carbon Nanotube micro-Raman spectroscopy

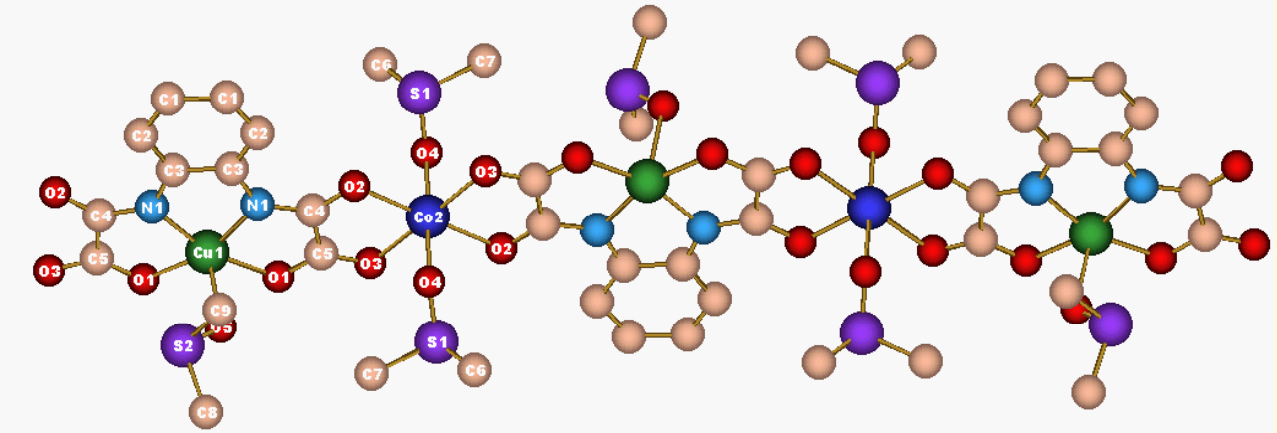
Micro-Raman Laboratory, Department of Physics,

University of Minas Gerais, Belo Horizonte

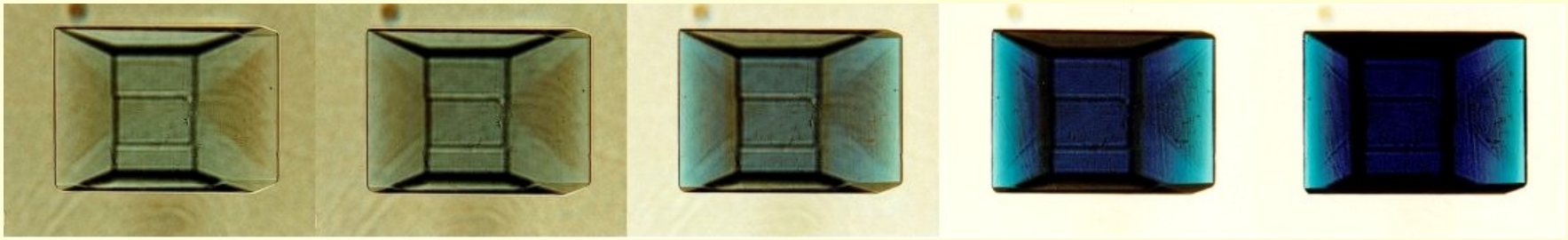




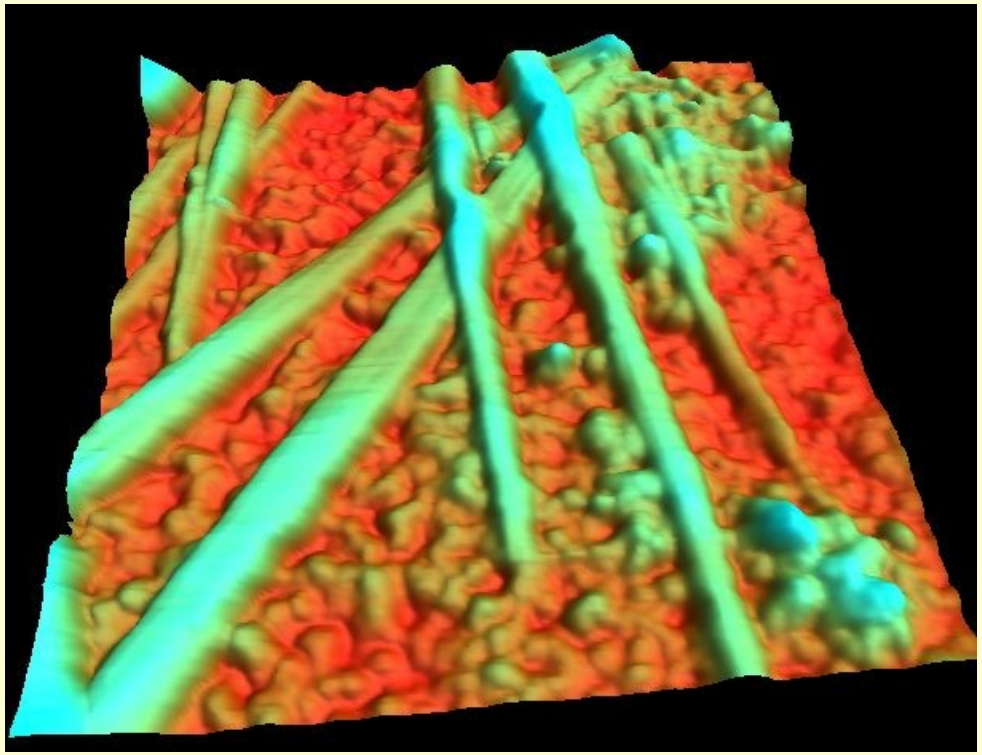
$CoCu(opba)(DMSO)_3$



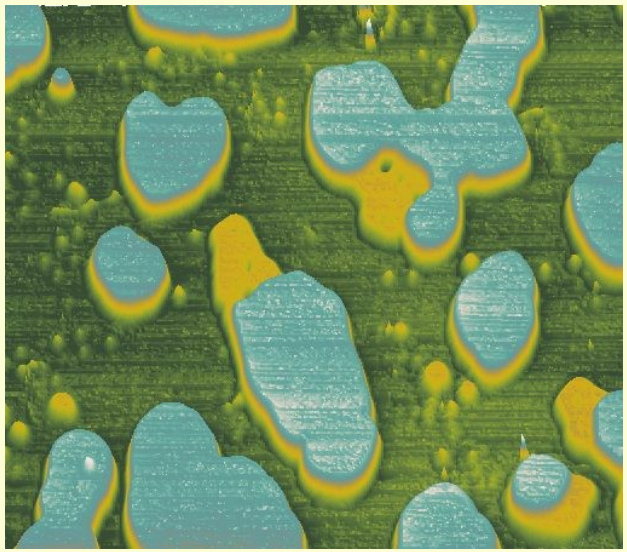
Well-shaped blue single crystals were obtained from a DMSO solution. $Co[Cu(opba)](DMSO)_3$ crystallizes in the orthorhombic system, space group P_{nma}. The lattice parameters are a= 7.7014(8) Å, b = 21.0678(13) Å, c = 14.8445(9) Å, Z = 4.



Views of a crystal $CoCu(opba)(DMSO)_3$ under polarised light :



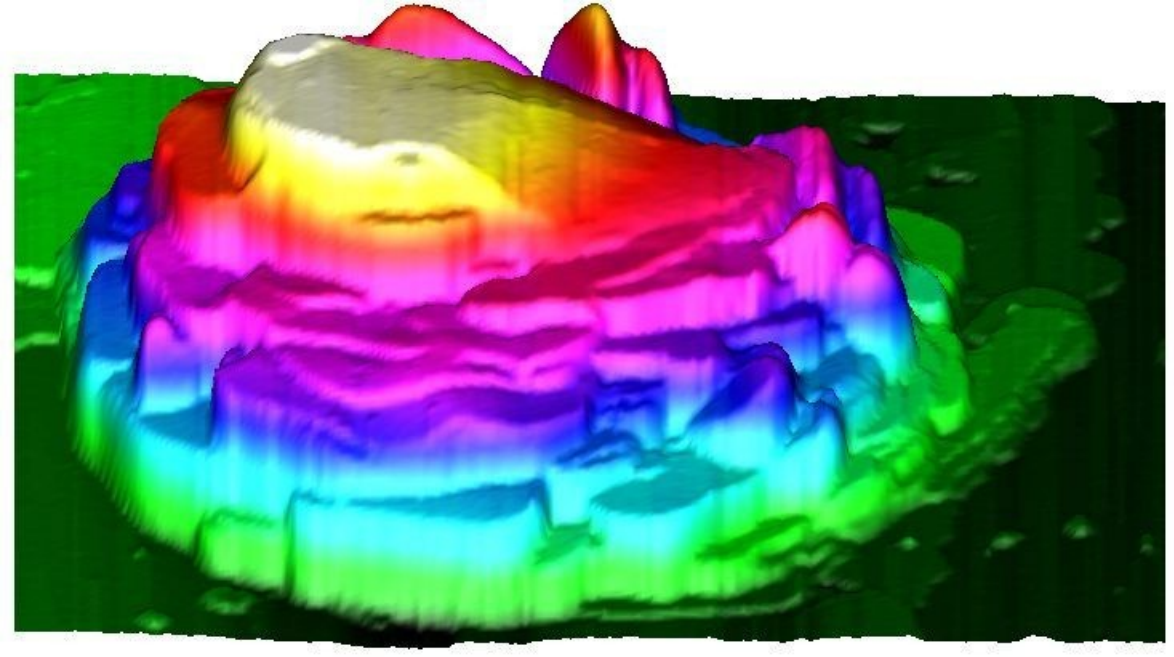
Nano-ribbons (~ 10 nm high,150 nm wide, > 1000 nm long) created by the reaction of Al with MPA (UFMG)



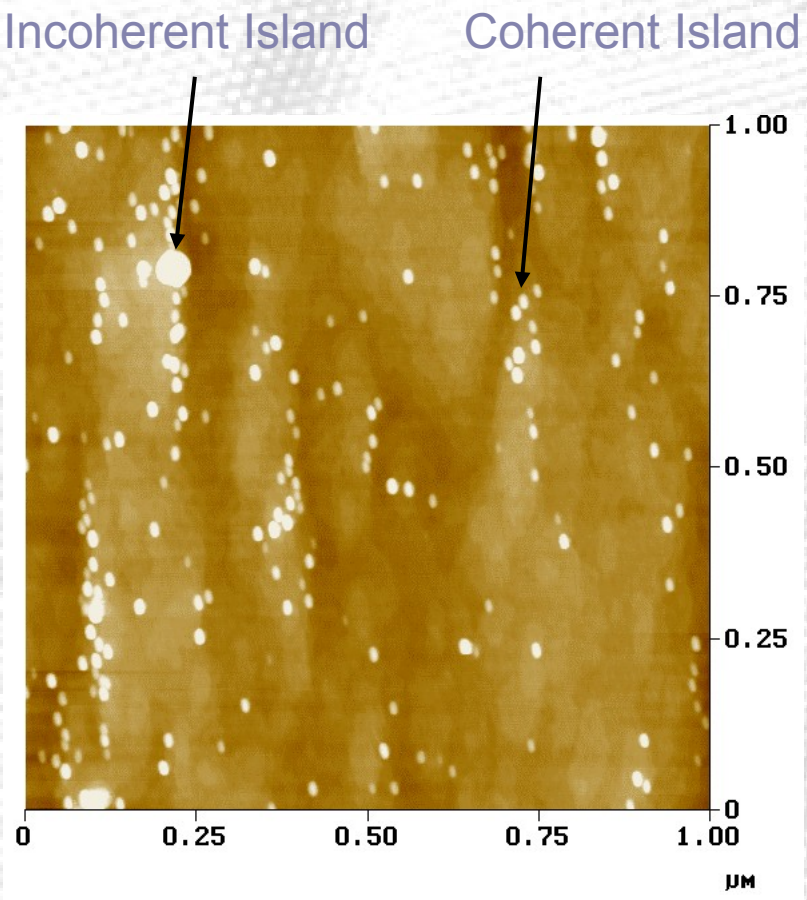
Above: double layers of OPA deposited over mica.

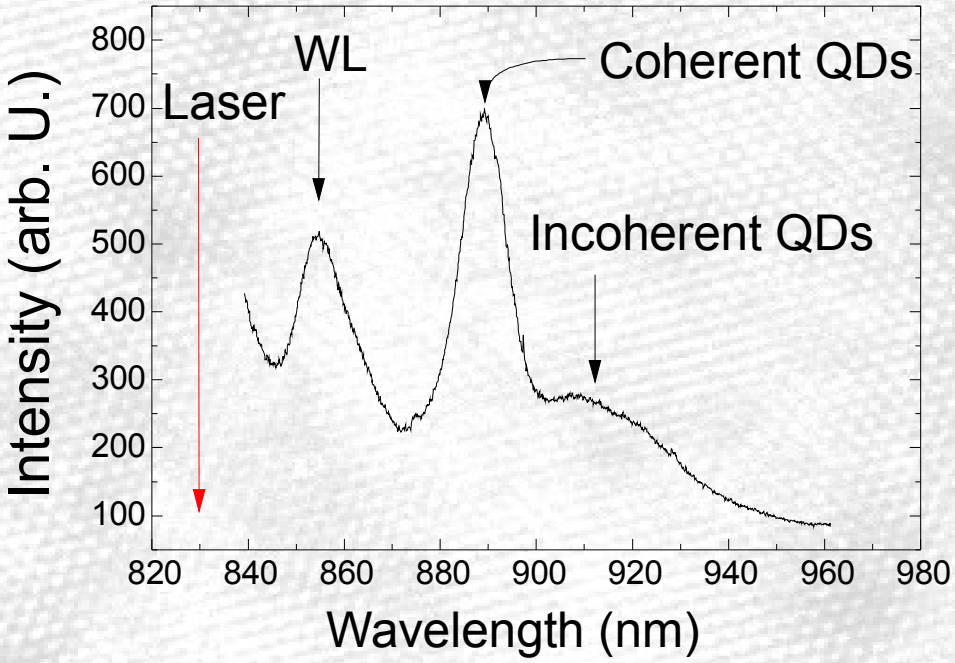
Below: temperature-induced piling of the layers

(UFMG)



InAs quantum dots multilayers: coherence - incoherence transition, the 2.1 ML sample.





Quantum Dots

Future lasers : higher eficiency

better temperature stability