# Institute of Experimental Physics

Slovak Academy of Sciences, Košice

Established on
January 1st, 1969

3 original physical branches:

- Cosmic rays
- High energy physics
- Magnetism

Present research activities cover basic research in several fields of modern physics as condensed matter, biophysics, space physics, subnuclear physics), as well as selected fields of chemical sciences, biological sciences and nanotechnology.

- Department of Subnuclear physics
- Department of Space physics
- Department of Magnetism
- Department of Low temperature physics
- Department of Metal physics
- Department of Biophysics
- Department of Theoretical physics
- Laboratory of Materials physics
- Laboratory of Nanomat. and applied magnetism
- Laboratory of Experimental chemical physics

Currently the Institute employs about 130 people, more than half being research scientists, and about 16 post-graduate students.

# Temperature scale: 273,15 Kelvin = 0°C

Temperature [ Kelvin ]

← Cores of hot stars

← Core of the Sun, nuclear energy

← Chemical energy

← Melting point of Tungsten

← Temperature suitable for life

← Cosmic relic radiation temperature
2.7 K – lowest temp. in nature

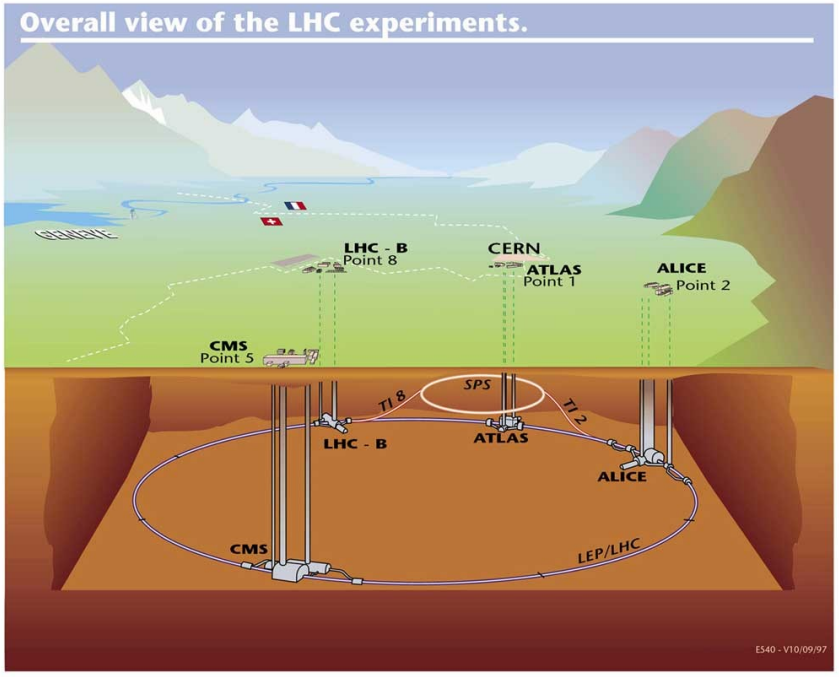
← Superfluid $^3$He

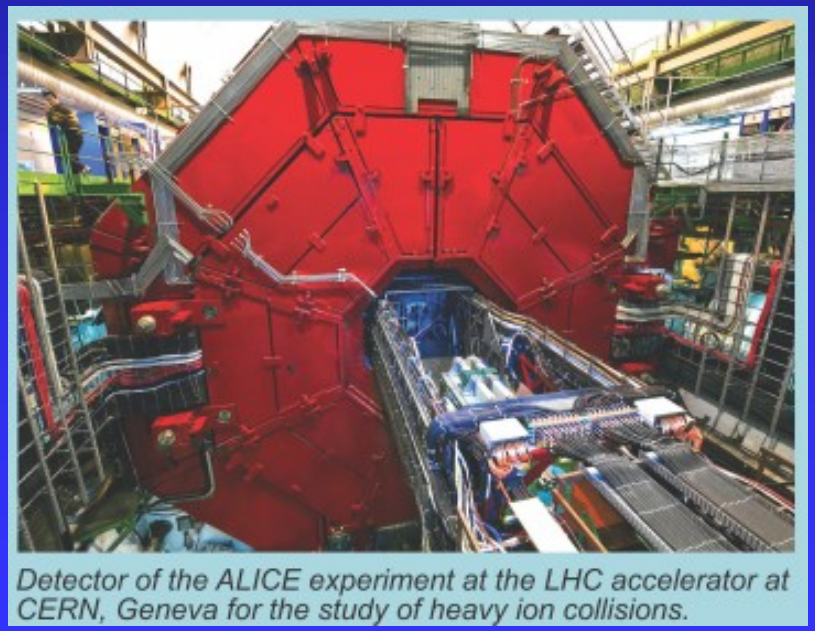
← μK - the lowest temperature reached in the laboratory

# Department of Subnuclear Physics

Research focuses on the structure of elementary particles and nuclear matter and involves ambitious collaborative experimental projects with world class accelerator centres such as the former Joint Institute for Nuclear Research in Dubna near Moscow or the Deutsches Elektronen Synchrotron Institute in Hamburg. Our current partners are the Fermilab Institute in Batavia, USA, and especially CERN in Geneva. At present two main research topics drive the Department, namely the study of top quark characteristics and the exploration of nuclear matter characteristics under extreme conditions.

## Exploration of the new state of nuclear matter



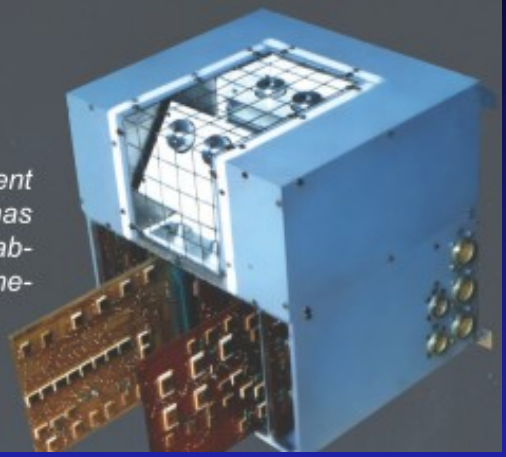



*Detector of the ALICE experiment at the LHC accelerator at CERN, Geneva for the study of heavy ion collisions.*

# Department of Space Physics

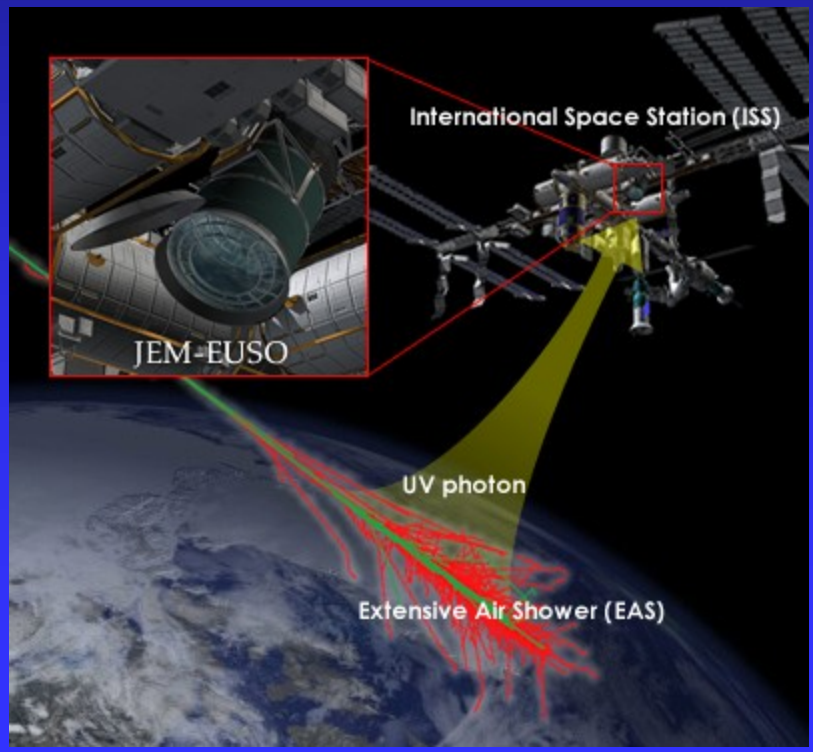
Research focuses on the physical processes that take place in the extreme conditions found in space that typically cannot be observed under laboratory conditions. Our goal is to gain novel information on cosmic energy particles including cosmic radiation. This is accomplished via the analysis of ground and satellite measurements, personal observations, simulation of physical processes in the Earth's heliosphere and magnetosphere, and preparation of new cosmic experiments.

The Department has participated in developing and implementing key components of experimental equipment placed on 14 satellites, two space probes and two high altitude rockets. Ground measurements are continuously collected from a neutron monitor at Lomnický Peak, with real-time data available at http://neutronmonitor.ta3.sk. For further information about the Department see http://space.saske.sk.



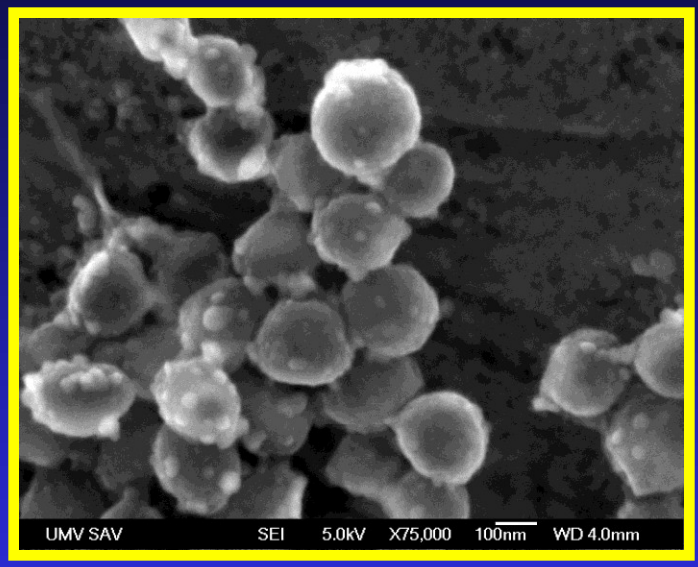
*Spectrometer of cosmic energetic particles DOK-2, developed at the Department of Space Physics IEP, has provided a wealth of valuable data on the Earth´s magnetosphere.*

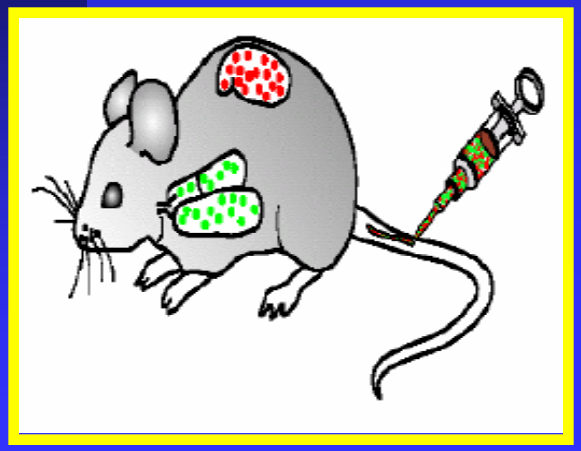
- Cosmic rays
- Space weather
- JEM-EUSO project - Based on the Japanese Experiment Module (JEM) on the International Space Station, JEM-EUSO is a new type of observatory that will utilize very large volumes of the earth's atmosphere as a detector of the most energetic particles in the Universe. JEM-EUSO (EUSO for "Extreme Universe Space Observatory") observes the very short flashes of light in the earth's atmosphere caused by particles arriving from deep space.

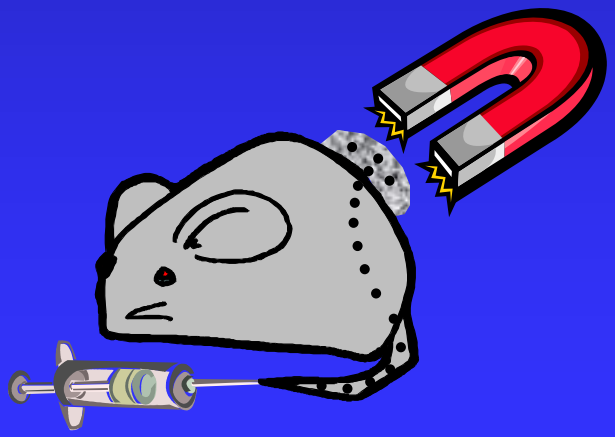


# Department of Magnetism

- Magnetic fluids
- Molecular magnets
- Intermetallic compounds

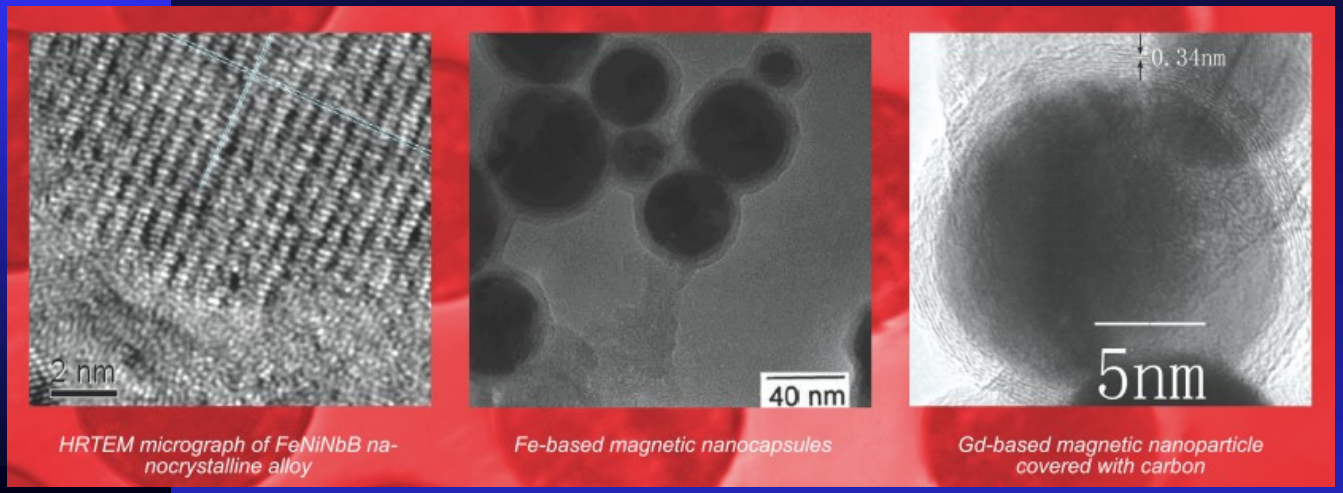




research
development
supply chain
hamelin
rds

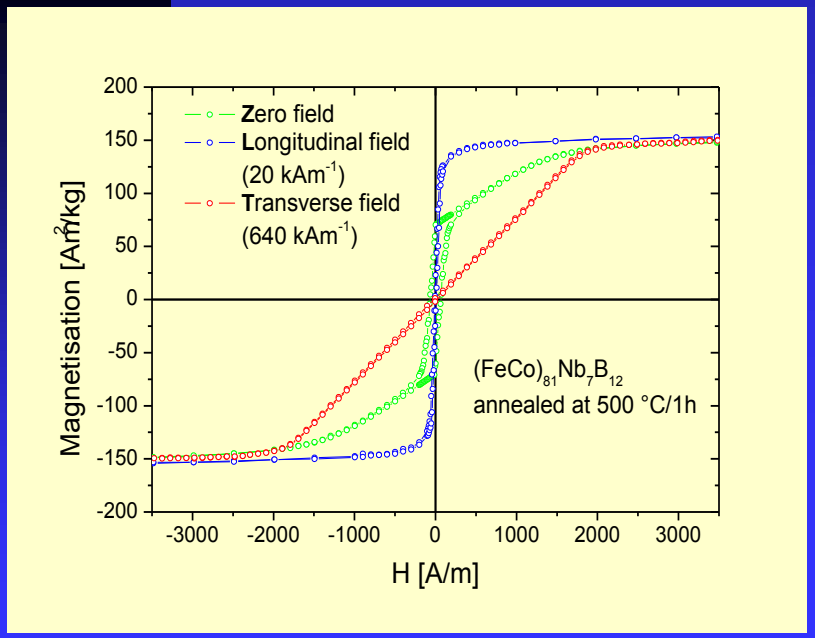
# Laboratory of Nanomaterials and Applied Magnetism

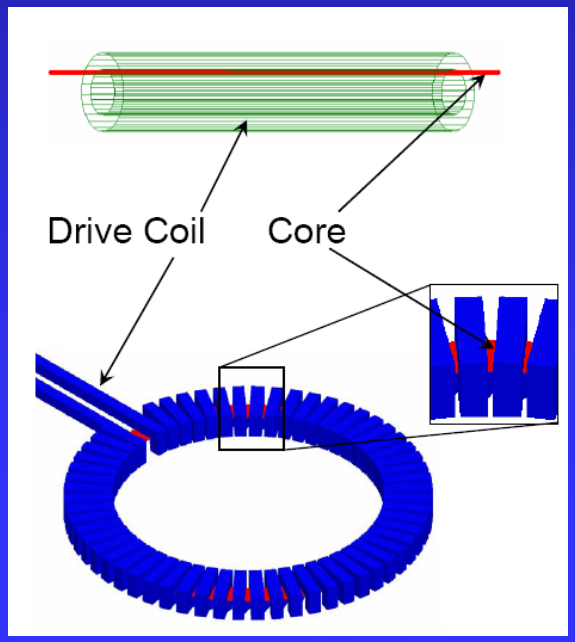



*HRTEM micrograph of FeNiNbB nanocrystalline alloy*

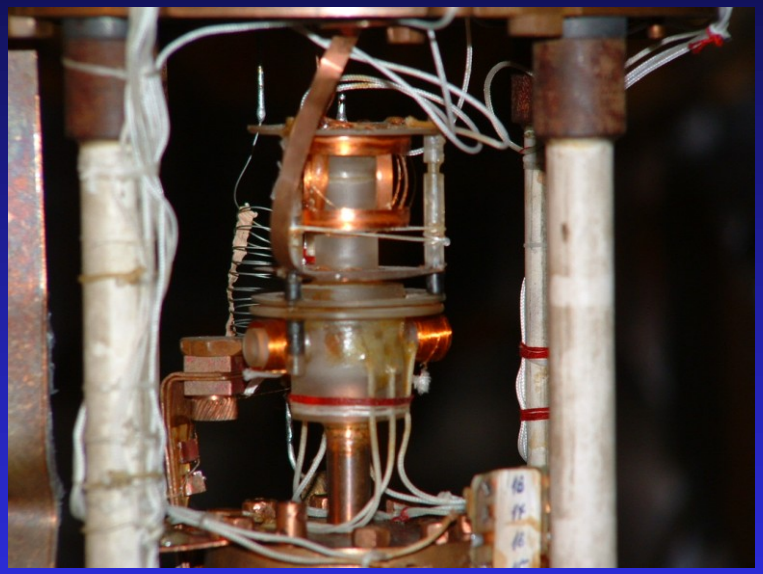
*Fe-based magnetic nanocapsules*

*Gd-based magnetic nanoparticle covered with carbon*



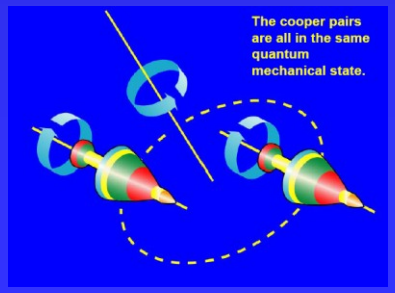



# Department of Low-Temperature Physics



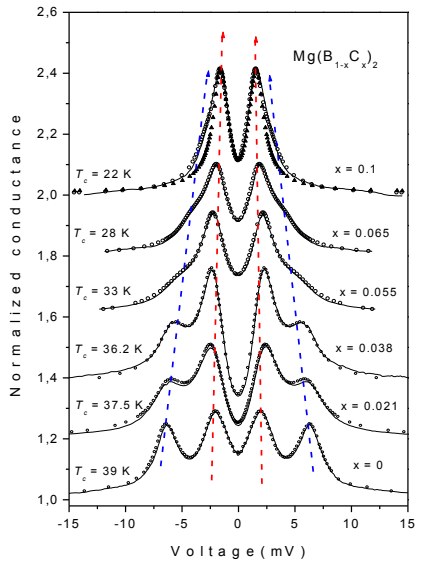
Superfluid $^3$He

Methods: pulse and continuous NMR, vibrating wire, magnetic susceptibility.

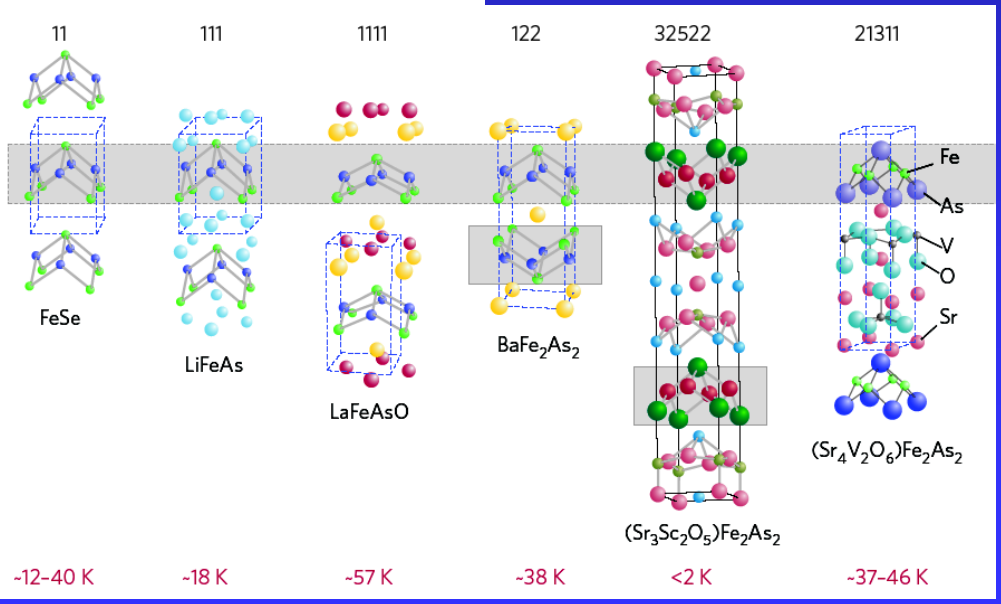



$$\Psi_S = |\Psi_{S0}|.e^{i\Phi}$$

# Department of Low-Temperature Physics

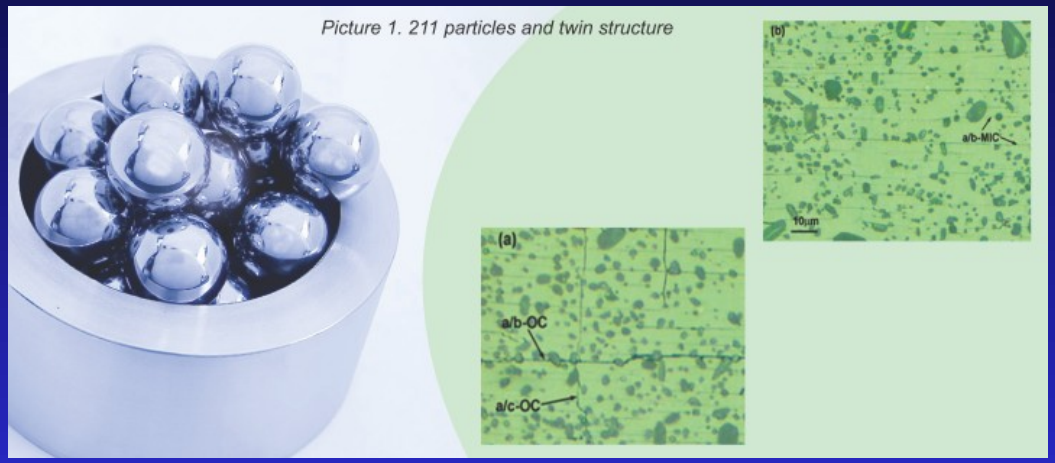


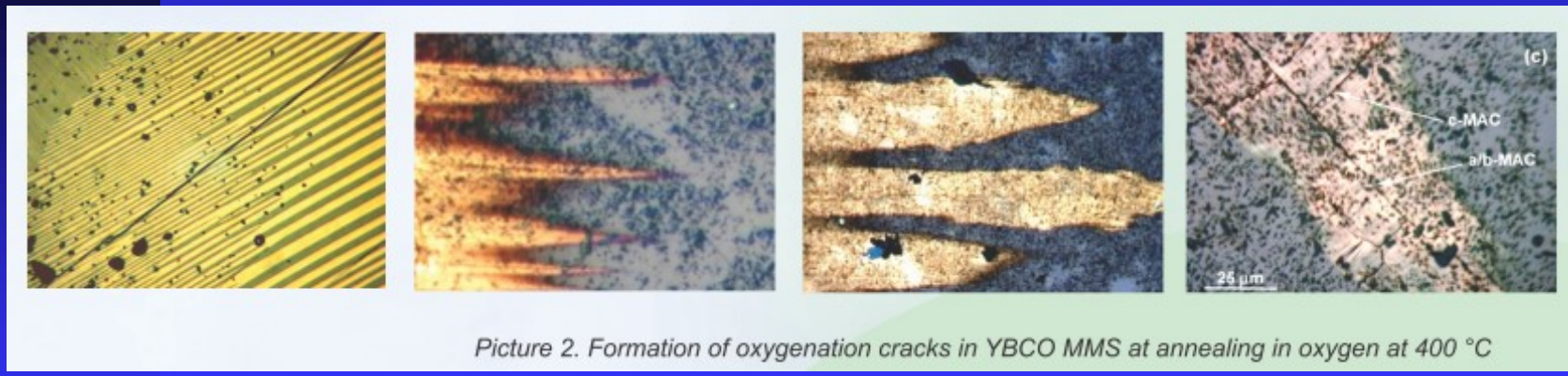

Two band / two gap superconductivity of pure and doped $MgB_2$




Superconductivity of iron pnictides

# Laboratory of Materials Physics

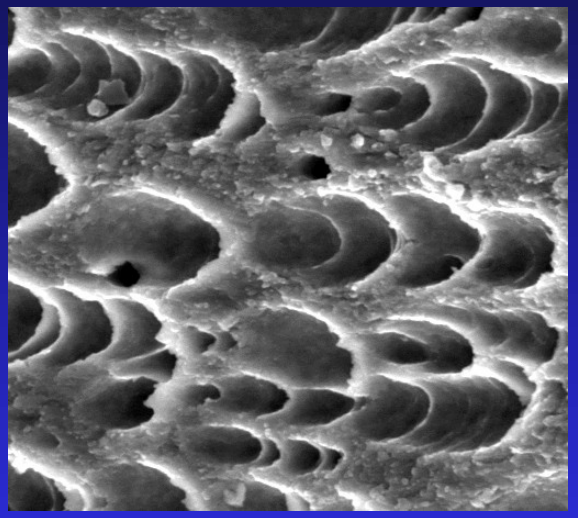


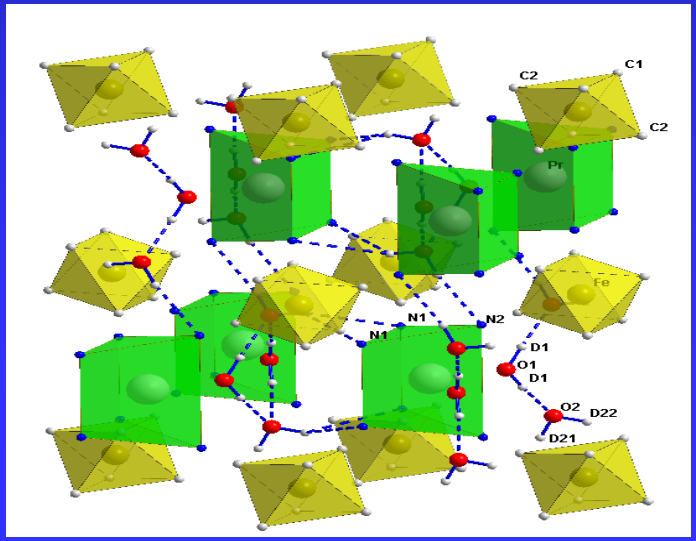

cuprate perovskites_

# Department of Metal Physics

- Study of mechanical properties, homogeneous and inhomogeneous deformation and creep of amorphous and nanocrystalline metals in a wide temperature range



- Study of correlations between the structure and physical properties of substances



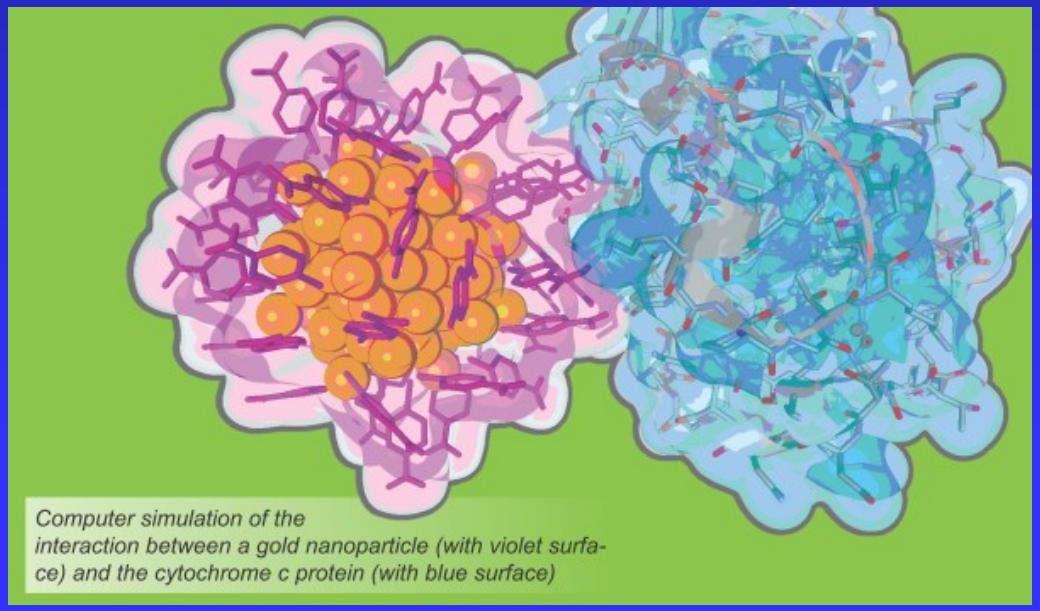
# Department of Biophysics

**Research fields of deparment:**

- amyloid structures
- nanoparticles
- protein stability
- image analysis
- molecular modelling

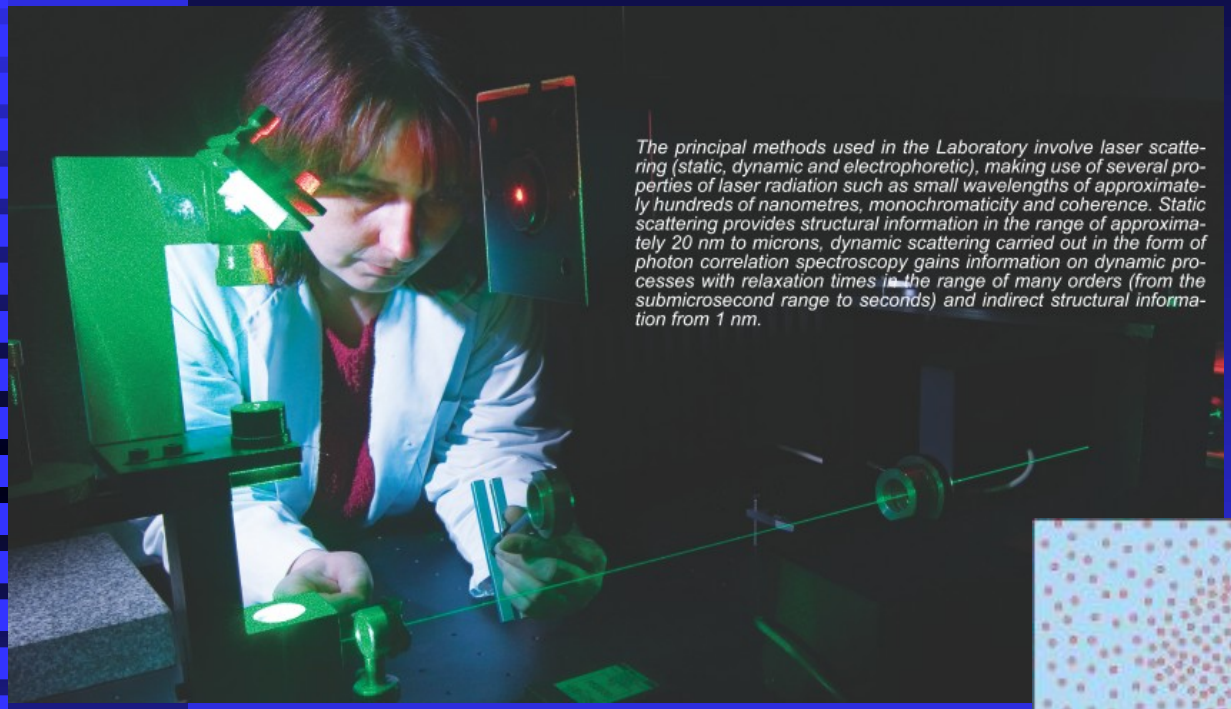
**Cancer**

**Alzheimer´s disease**

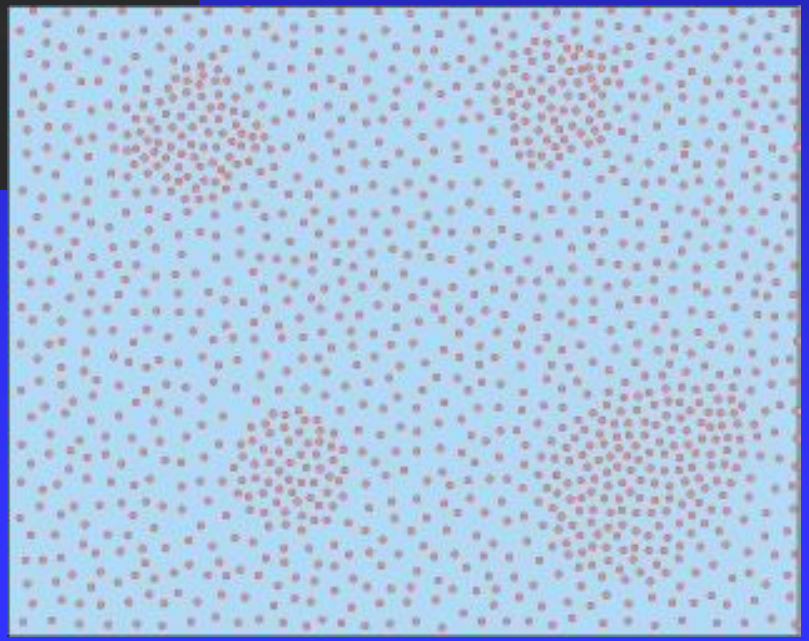


*Computer simulation of the interaction between a gold nanoparticle (with violet surface) and the cytochrome c protein (with blue surface)*

# Laboratory of Experimental Chemical Physics

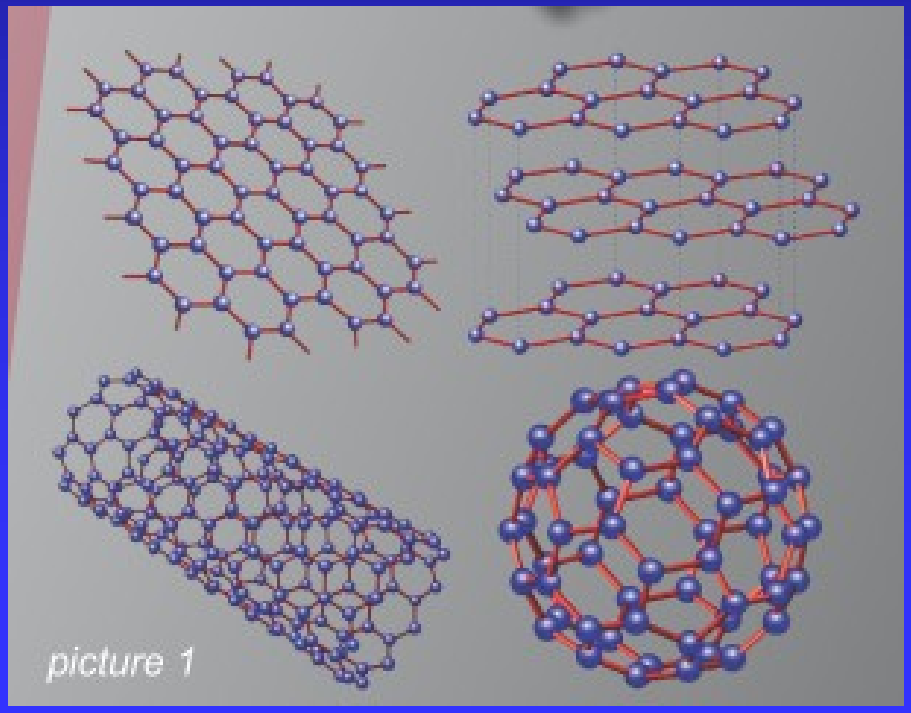



Macromolecular systems by laser scattering



# Department of Theoretical Physics

The Department of Theoretical Physics has multidisciplinary character and specializes in a wide range of physics problems such as condensed matter physics, stochastic processes like turbulence, particle and space physics, as well as the definition of electronic properties of nanostructures. It uses various methods for tackling the given tasks. The following part of this short Departmental presentation focuses on the theme of carbon nanostructures.



# Košice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Thank you very much
for your attention
and
have a nice and successful stay
in Slovakia