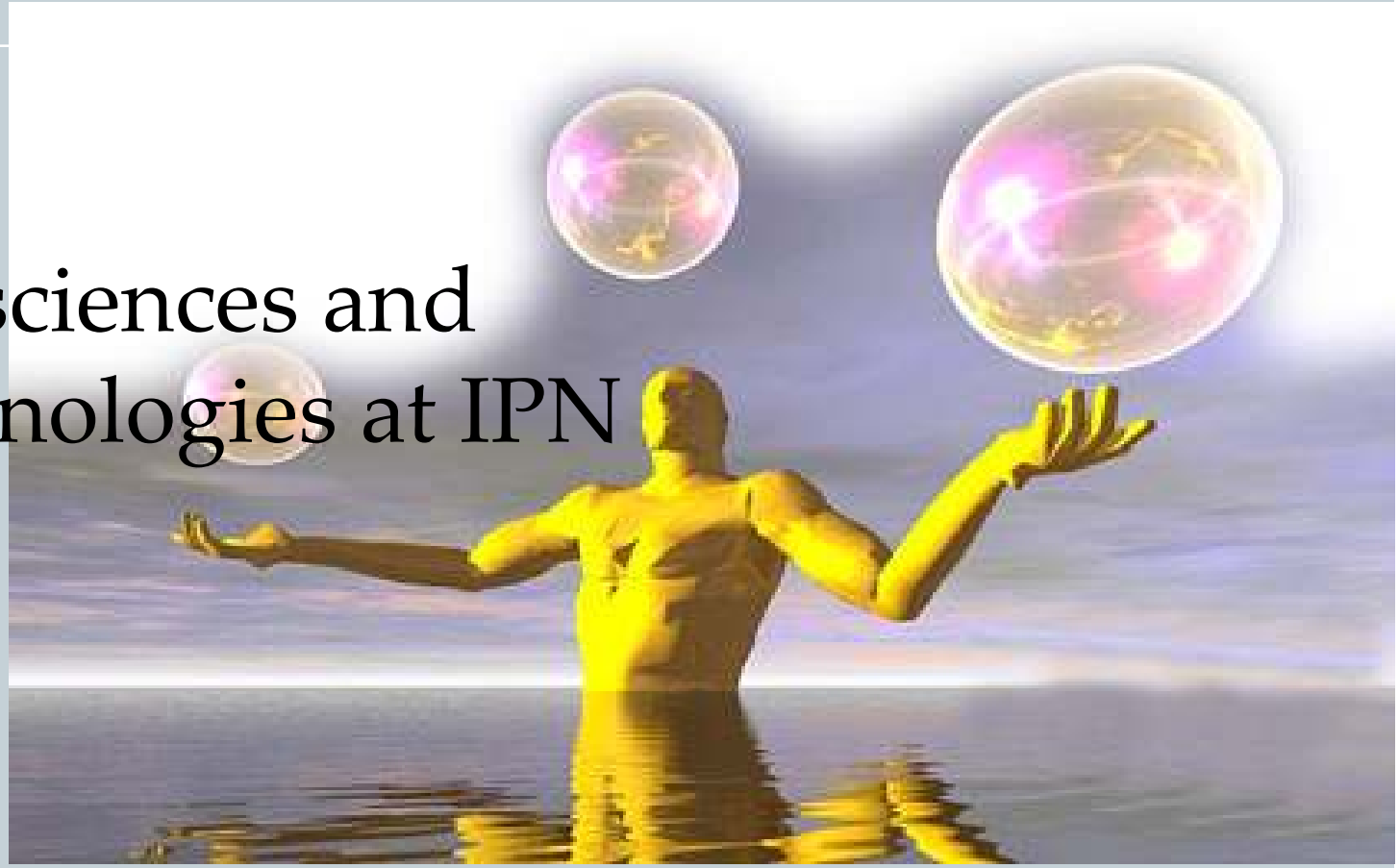
INSTITUTO POLITECNICO NACIONAL

Nanosciences and Nanotechnologies at IPN



J. G. Cabañas Moreno

Center for Nanoscience and Micro-Nanotechnology

Nanosciences y Nanotechnologies at Instituto Politécnico Nacional

BACKGROUND

Global Importance of NN
to develop at the atomic and molecular level

new knowledge, tools, techniques
for application in the solution of 21st century priorities

Instituto Politécnico Nacional (IPN)

- **one of three national institutions**
- **approx. 175,000 students (high school → graduate school)**
- **approx. 20,000 employees (10,000 full-time faculty members)**
- **approx. 40 schools and research centres distributed all over Mexico**

Nanosciences y Nanotechnologies at
Instituto Politécnico Nacional

STRATEGIES

[1] Formation of institutional NMN network

- **Need to tackle complex, multidisciplinary problems**
- **Need intramural collaboration and synergism**

→ Break artificial barriers among Schools & Dept´s

[2] Creation of Center for Nanoscience and Micro-Nanotechnology

- **Provide state-of-the-art equipment and facilities**
- **Support NMN network activities (and viceversa)**
- **Support IPN participation in national & international NANO initiatives**

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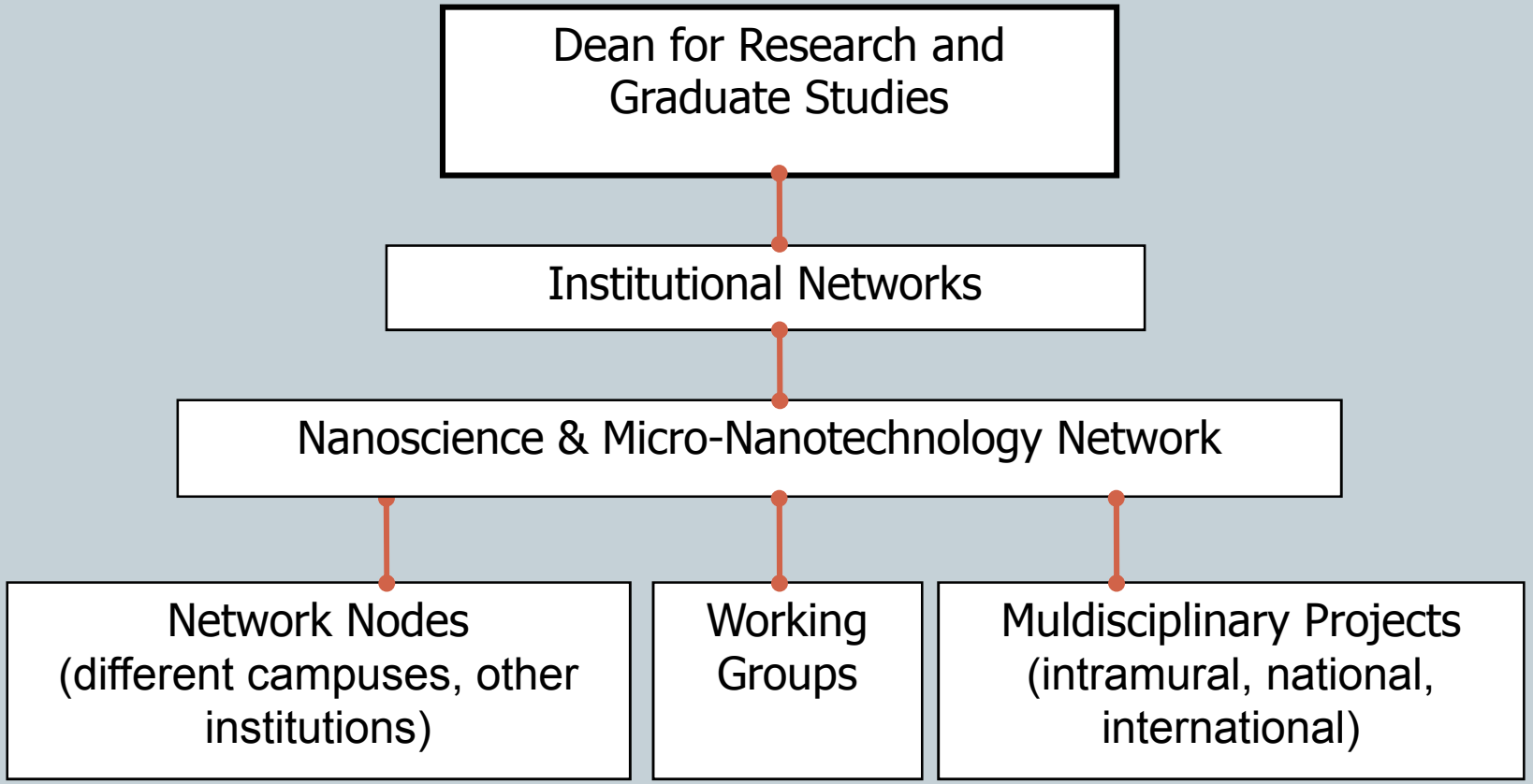
NMN Network– Organization



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RESEARCH AGENDA

- **Energy**
  (photovoltaics, solar, hydrogen technology, electricity generation and distribution,...)
- **Environment**
  (soil and mineral tailings remediation, characterization and degradation of contaminants, ...)
- **Health**
  (drug delivery, techniques for body exploration, cancer treatment, ...)
- **Materials**
  (catalysts, membranes, bulk nanostructured materials, molecular simulation, semiconductors, nanoparticles, nanofabrication, ...)
- **Microelectronics and devices**
  (IC, MEMS, sensors, biomedical devices, ...)

+ EDUCATION - (high school to graduate school)

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Center for Nanoscience and Micro-Nanotechnology

Mission: Support activities & initiatives in IPN related to NMN

- **state-of-the-art facilities and equipment**
- **provide access (expertise) to modern facilities (techniques) for researches and students**
- **optimize utilization & timely update of expensive equipment**
- **support Associate laboratories located at Schools & Research Centers within IPN**
- **support communication with governmental, social and industrial organizations interested in NMN**

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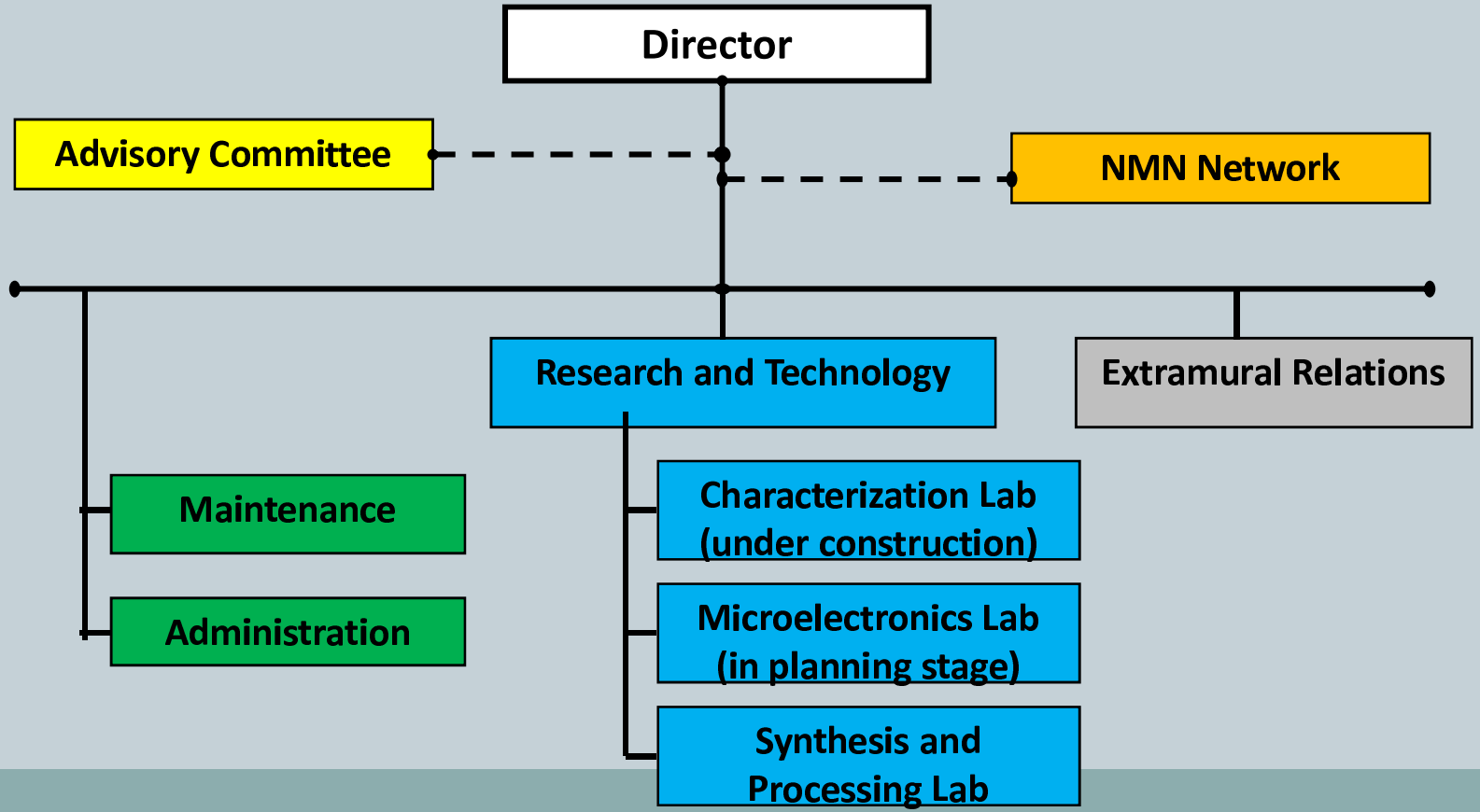
Center for Nanoscience and Micro-Nanotechnology - Organization -



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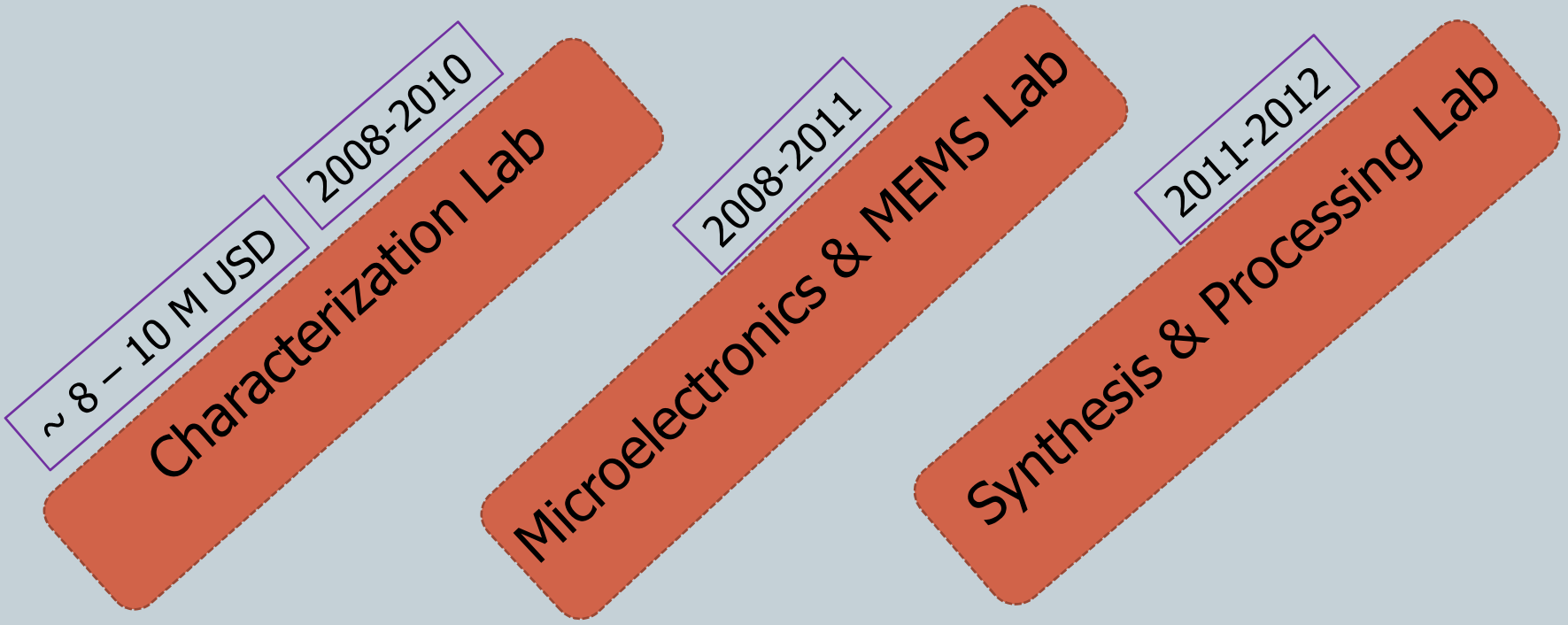
Center for NMN
Laboratory Facilities (original plan)



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Characterization Laboratory - Facilities -

- X-Ray Diffraction
- Spectroscopies
- Microscopies
- Physical and Chemical Properties

Lab building (400 m^2) to be deliver in April 2009
Equipment being purchased at this time

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Microelectronics & MEMS Laboratory - in the planning stage -

Desired Capabilities (IC, MEMS)

- Design
- Characterization
- Fabrication (limited)

Expecting to have a blueprint in 2-3 months

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Research Activities on NMN at IPN (broad classification)

NANOPARTICLES AND MICROORGANISMS
NANOPARTICLES IN MEDICAL APPLICATIONS

NANOSTRUCTURED MATERIALS IN BIOTECHNOLOGY AND FOOD APPLICATIONS

NANOSTRUCTURED MATERIALS AND ENVIRONMENTAL APPLICATIONS
NANOSTRUCTURED MATERIALS AND SENSORS

NANOSTRUCTURED MATERIALS AND CATALYSIS/PHOTOCATALYSIS
NANOSTRUCTURED MATERIALS AND HYDROGEN PRODUCTION AND STORAGE

SEMICONDUCTOR THIN FILMS AND ENERGY APPLICATIONS

NANOSTRUCTURED MATERIALS FOR STRUCTURAL APPLICATIONS

MEMS DESIGN

Thank you for your attention

Characterization Laboratory

X-Ray Diffraction – (alta potencia, alta resolución, texturas)

Espectroscopías – resonancia magnética nuclear (NMR) sólidos, microRaman de alta resolución, resonancia electrónica paramagnética, espectroscopía de fotoelectrones (XPS) + espectroscopía Auger, espectroscopía de masas

Microscopías – óptica confocal, electrónica de barrido de alta resolución (SEM-FEG), haz de iones enfocado (FIB-SEM-FEG), electrónica de transmisión de resolución atómica (TEM), de fuerza atómica (AFM), de tunelamiento (STM)

Propiedades Físico-Químicas – magnéticas (SQUID), análisis de partículas, AFM multifuncional, espectrofotometría