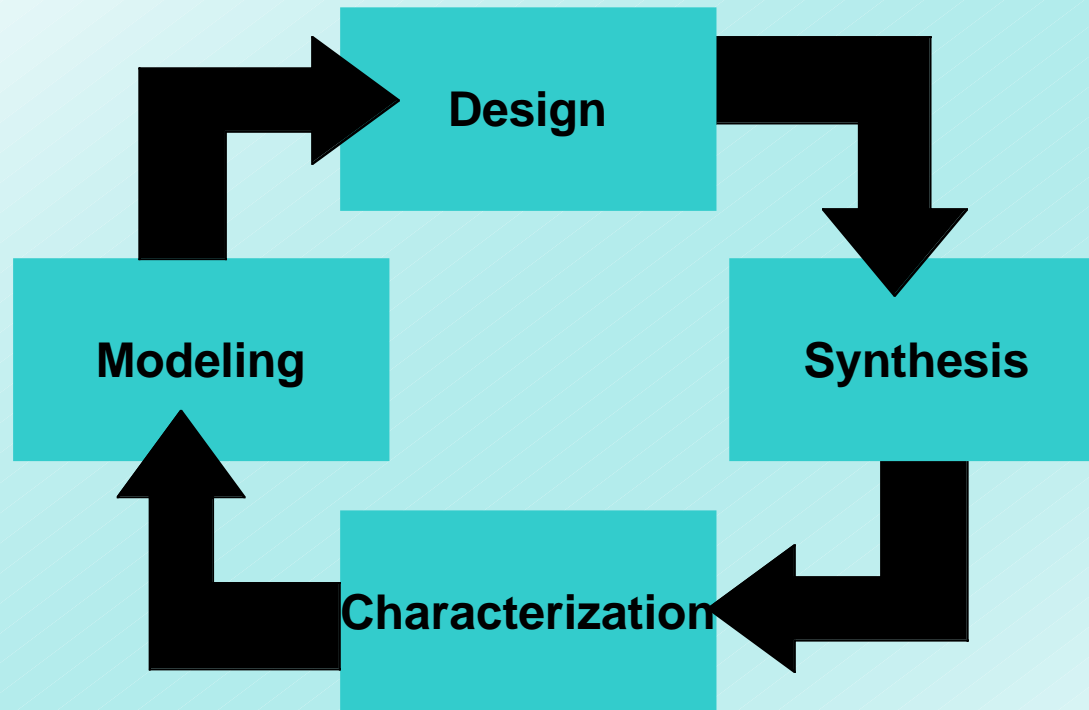


Nanoscale Science Research Centers

Synthesis: The Role of Materials in Discovery

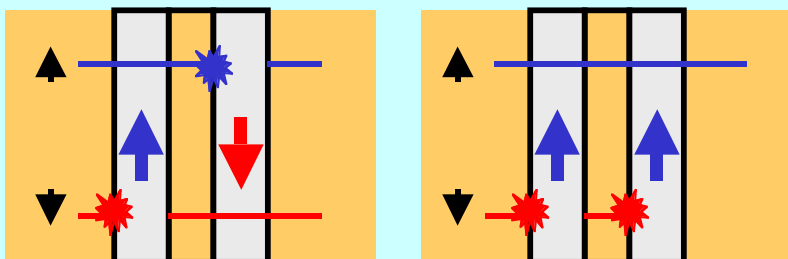


Center for Nanophase Materials Sciences

A highly collaborative program in partnership with Universities, Government Laboratories and the Private Sector

Advanced Materials: An Intellectual & Technological Frontier

Giant Magnetoresistance



Spin Valve (1988)



**The IBM Travelstar disk: 4.1
(1978)in²**

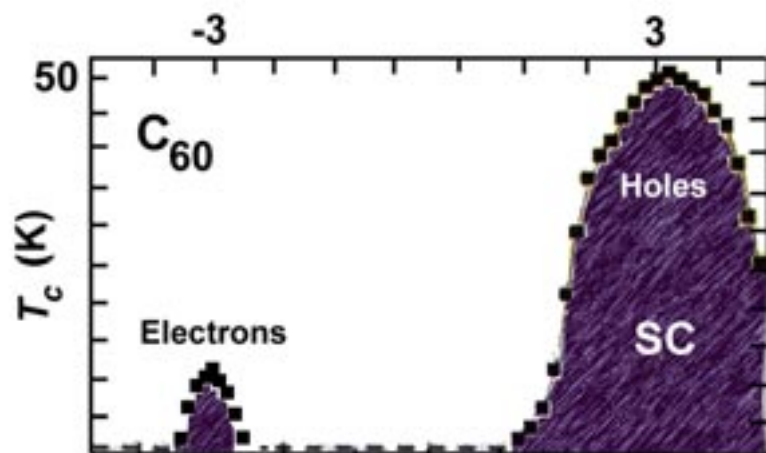
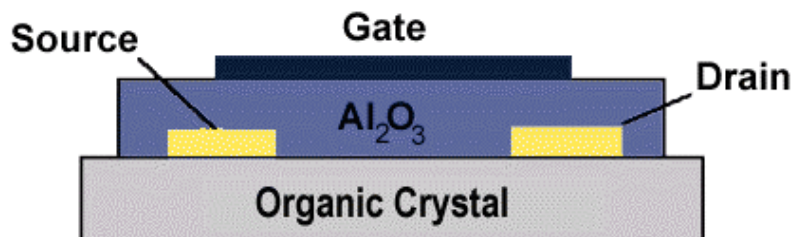
Future Nobel Prizes

- Giant magnetoresistance

- Integrated circuit (2000)
- Conducting polymers (2000)

Advanced Materials: An Intellectual & Technological Frontier

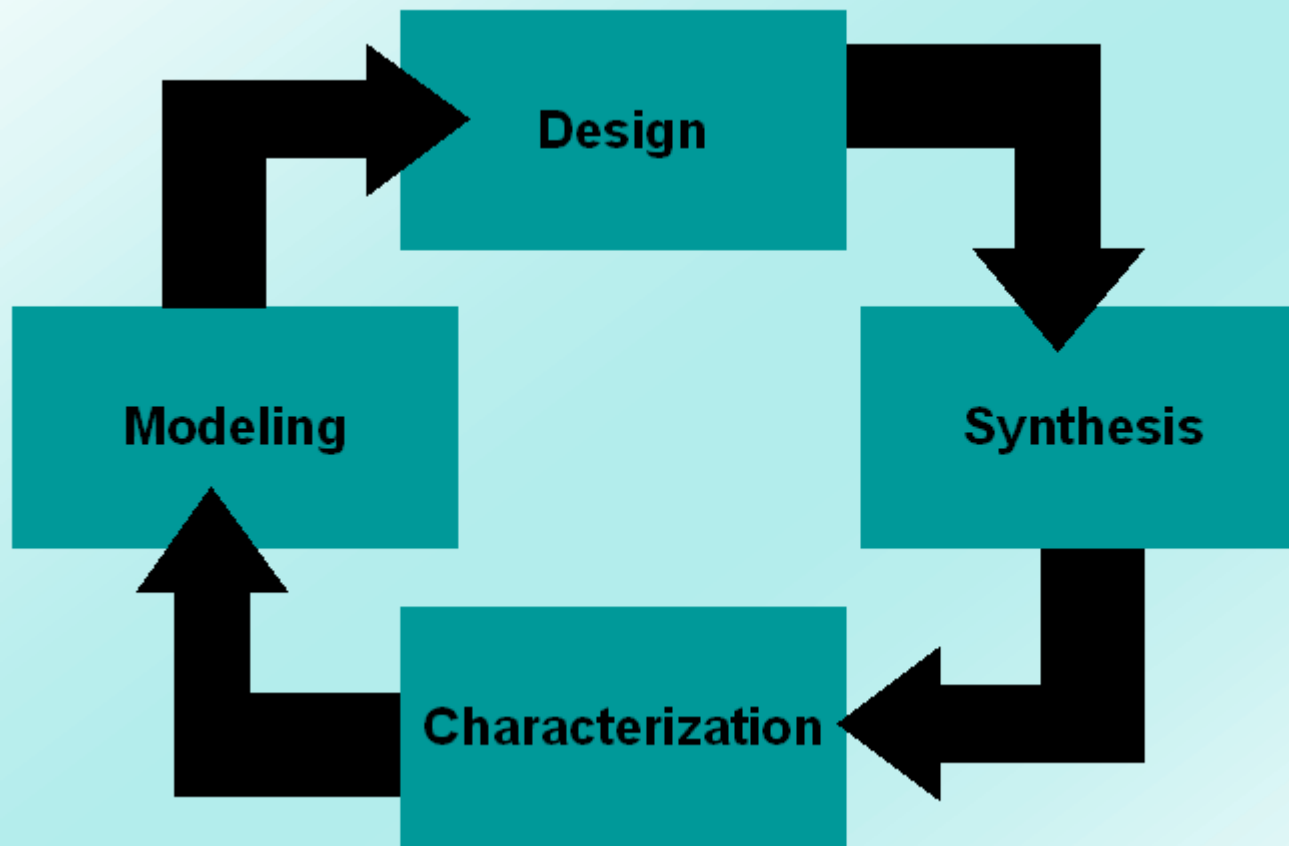
Field Effect Transition



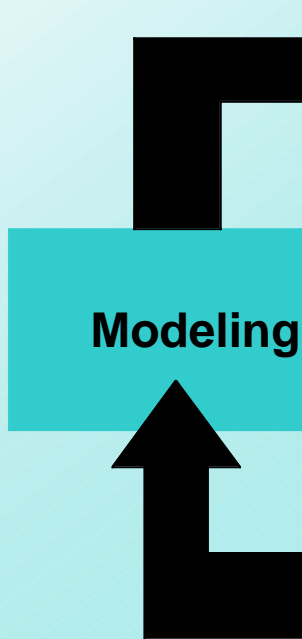
Future Nobel Prizes

- Giant Magnetoresistance
- Organic Superconductors
- A CNMS Discovery

CNMS Philosophy: Whoever controls the materials controls the science and the technology

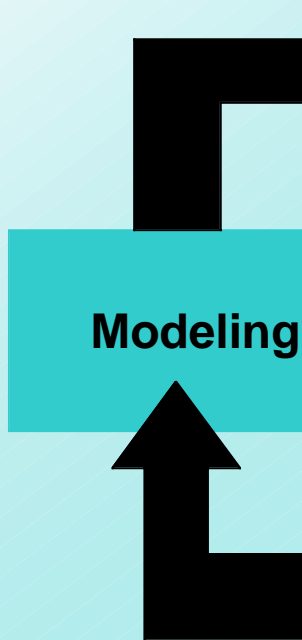


CNMS Philosophy: Whoever controls the materials controls the science and the technology



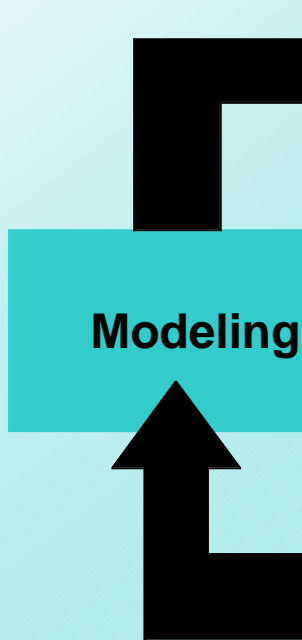
**Science
Driven
Synthesis**

CNMS Philosophy: Whoever controls the materials controls the science and the technology



**Technological
ly Driven
Processing**

CNMS Philosophy: Whoever controls the materials controls the science and the technology



**Science
Driven
Nanofabricati
on**

Nanophase Materials Sciences Workshop

(Oct. 24-26)

Magnetism in Nanostructured Materials

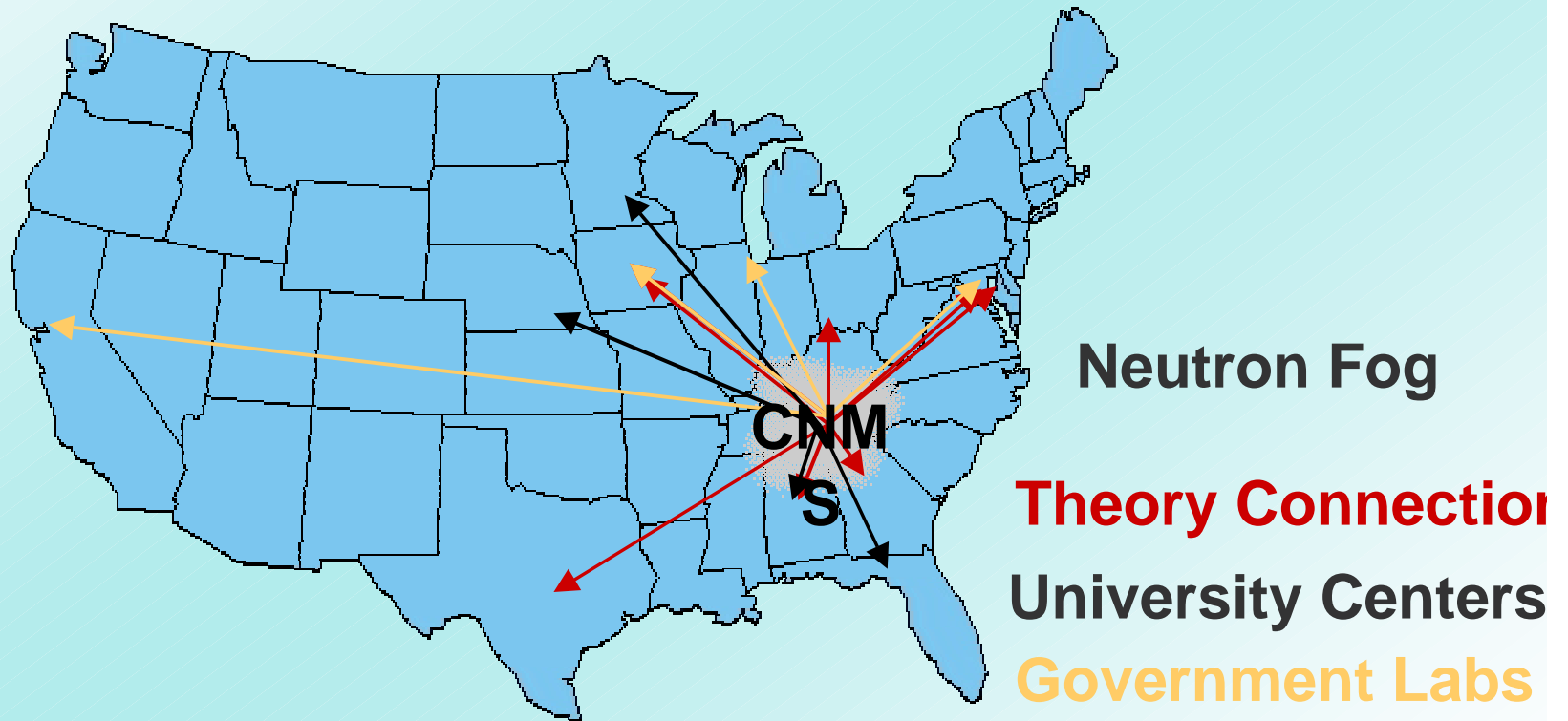
Scientific challenges to be addressed

- Synthesis and controlled assembly of magnetic nanostructures.
- Understanding magnetism in dimensionally confined systems
- Control and exploitation of spin and spin-currents
- Entanglement and decoherence
- First principles based many-body theory for correlated

Technological opportunities to be addressed

- Nano-bit storage
- Nanostructured permanent magnets
- Spintronic devices
- Magnetic random access memory
- Biological and chemical sensors with nano-magnetic components
- Quantum computing

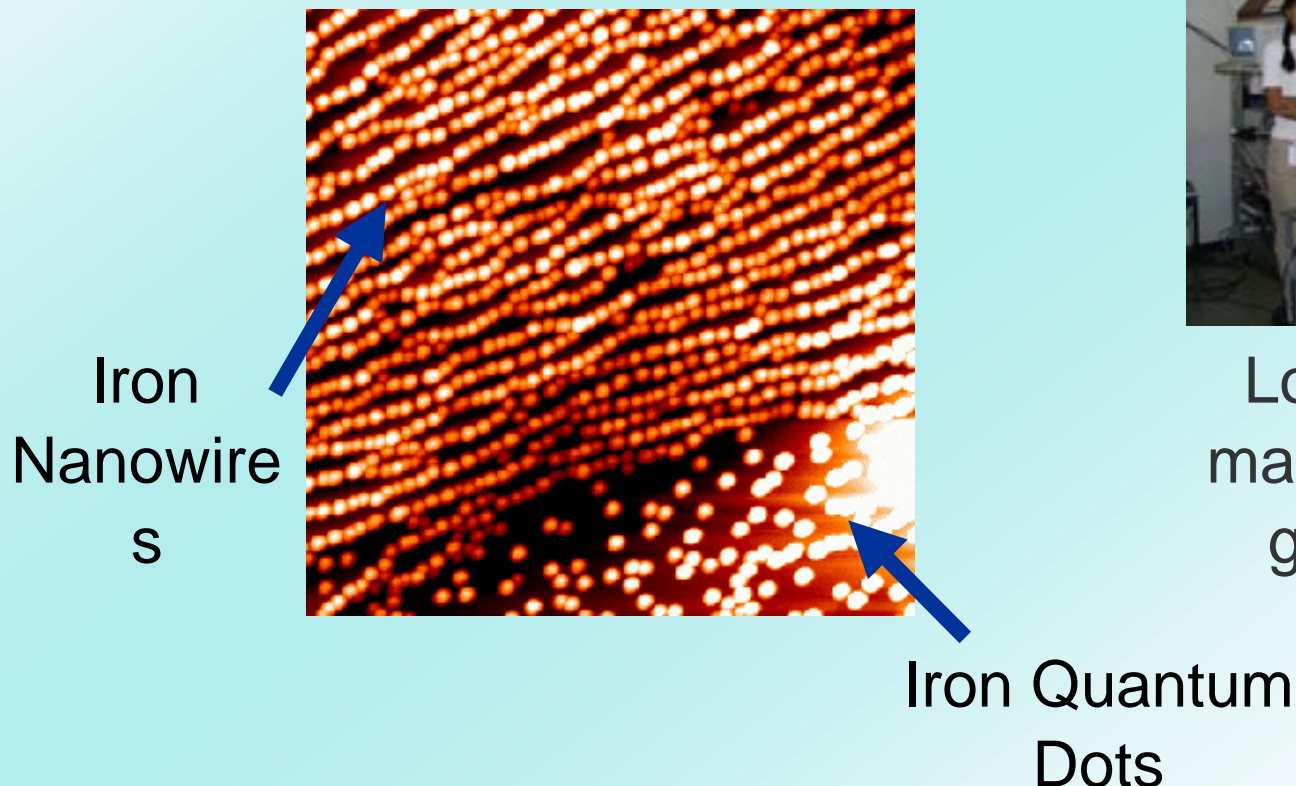
Research Focus Area: Magnetism in Nanostructured Materials



Magnetism in Nanostructured Materials

Magnetic Nanowires

- AFM image of self-assembled magnetic iron nanowires on sodium chloride



Low dimensional materials by design group at ORNL

Nanophase Materials Sciences Workshop

(Oct. 24-26)

Magnetism in Nanostructured Materials

– Scientific challenges to be addressed

- Synthesis and controlled assembly of magnetic nanostructures.
- Understanding magnetism in dimensionally confined systems
- Control and exploitation of spin and spin-currents
- Entanglement and decoherence
- First principles based many-body theory for correlated electron systems (KKR + DMFT/DCA)

– Technological opportunities to be addressed

- Nano-bit storage
- Nanostructured permanent magnets
- Spintronic devices
- Magnetic random access memory
- Biological and chemical sensors with nano-magnetic components
- Quantum computing

Champions

– University/Other External

- Bill Butler (MINT-Univ. of Alabama)
- Ward Plummer (Univ. of Tennessee)
- R. Sellmyer (Univ. of Nebraska)
- Stephan von Molnar (MARTEC, FSU)
- Sankar das Sarma (Univ. of Maryland) and/or Allan MacDonald (Univ. of Texas)

– ORNL

- Experiment (synthesis / characterization):
 - Jian Shen (SSD)
 - Jim Thompson (SSD)
- Theory and modeling:
 - Thomas Schulthess (CSMD)
 - Malcolm Stocks (M&C)
- Neutron experiments and SNS/HIFR contacts: