

# **An International Virtual Institute Concept**

**Cyber-Infrastructure for the  
Global Nanotechnology Network**

**R.P.H. Chang, Northwestern University**

# Outline

- Introduction
- International Virtual Institute (IVI) Concept
- Global Research Gallery (GRG)
- IVI Functions under Development
- IVI Applications in Progress
  - Nanotechnology Course Development
  - Collaborations in Research and Proposal Preparation
- Evaluation Center
- Conclusion

# Introduction

What can a cyber-infrastructure offer in general?

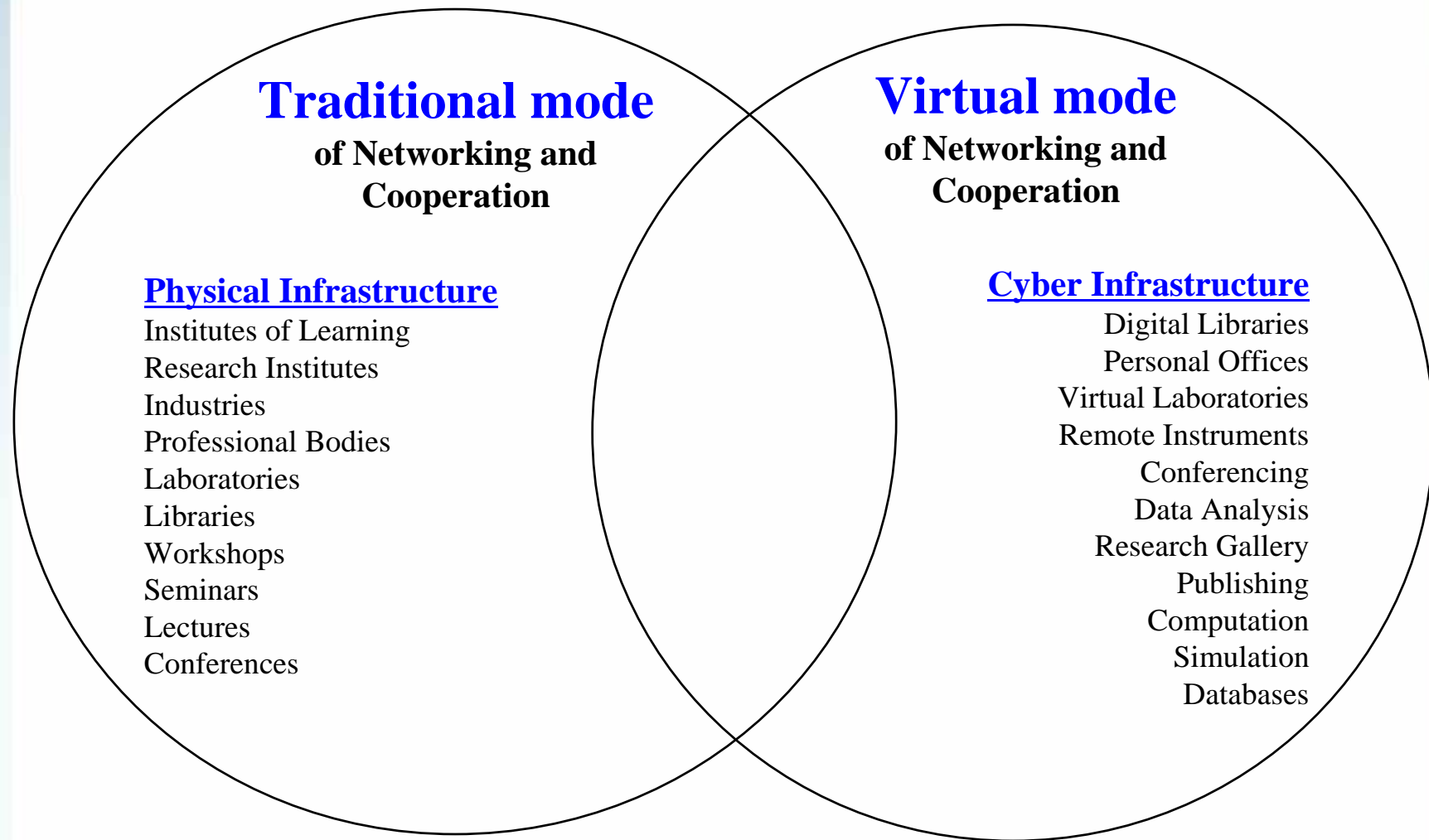
- Global Meeting Place
- Discussion Forum
- Shared Information Resources
- Collaboration Tools and Services
- Data Sharing Platform
- Etc...

More specifically, how might the GNN use a cyber-infrastructure?

- Develop the Network
- Link to other Networks
- Support Research Collaborations
- Publish & Disseminate Information
- Deliver Services to Members
- Manage Network Operations
- Evaluate and Update Network Services

### Summary:

A cyber-infrastructure can  
*support the real space activities*  
of the GNN and *enhance*  
*traditional modes of interaction*  
among its members.

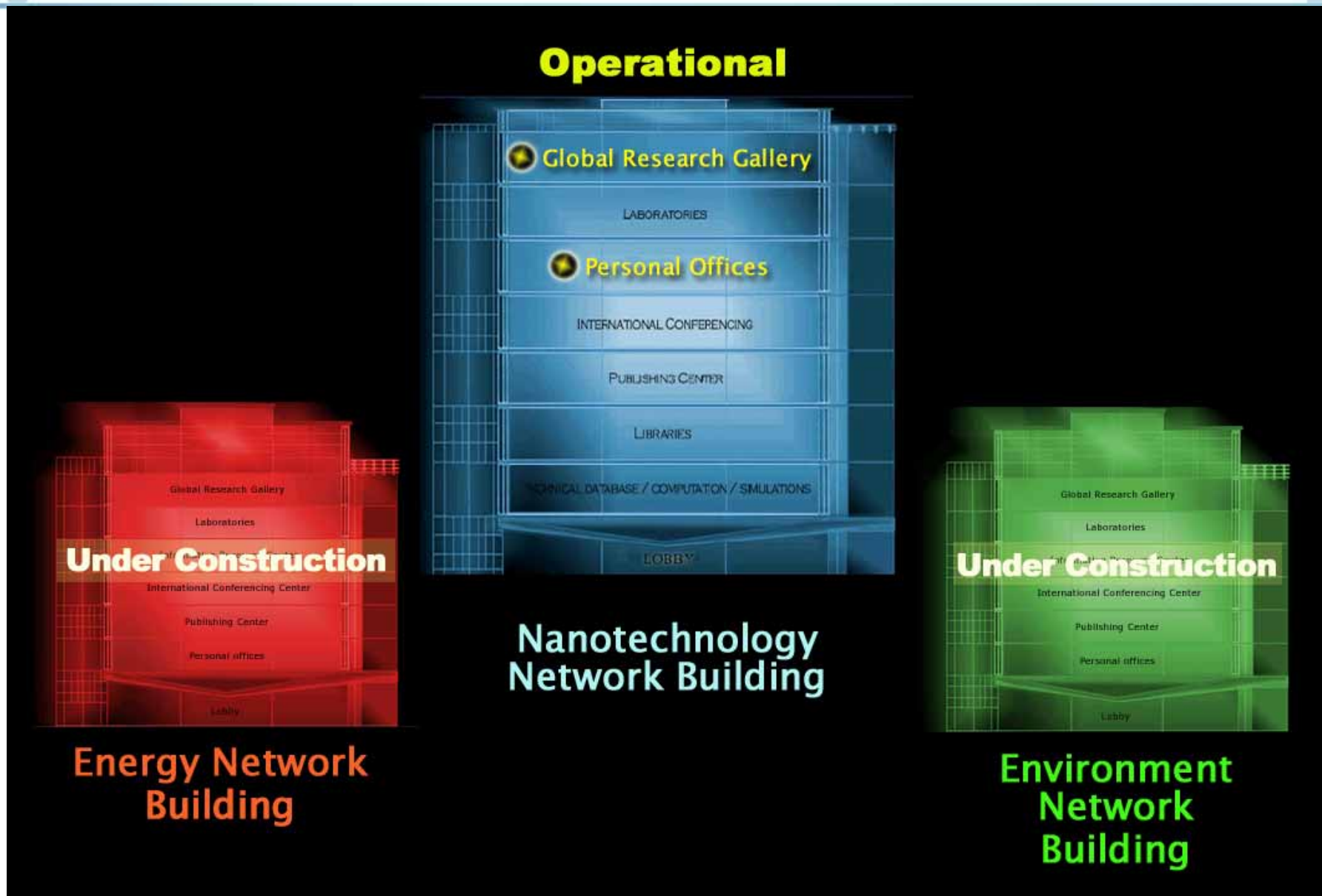


# International Virtual Institute Concept

## What is the IVI?

- A cyber-infrastructure designed to enhance global collaborations in research and education
- Prototype concept under development at Northwestern
- Conceptual Design: campus buildings in cyberspace, with seamless entry from anywhere in the world.
- Each building has a special topical area: Nanotechnology, Energy, Environment, etc...
- Each floor has a focused function: Global Research Gallery, Information Resource Center, International Conferencing Center, Personal Offices, etc..
- One might envision the GNN housed in a Nano building on this “cyber-campus”

# Topical Networks





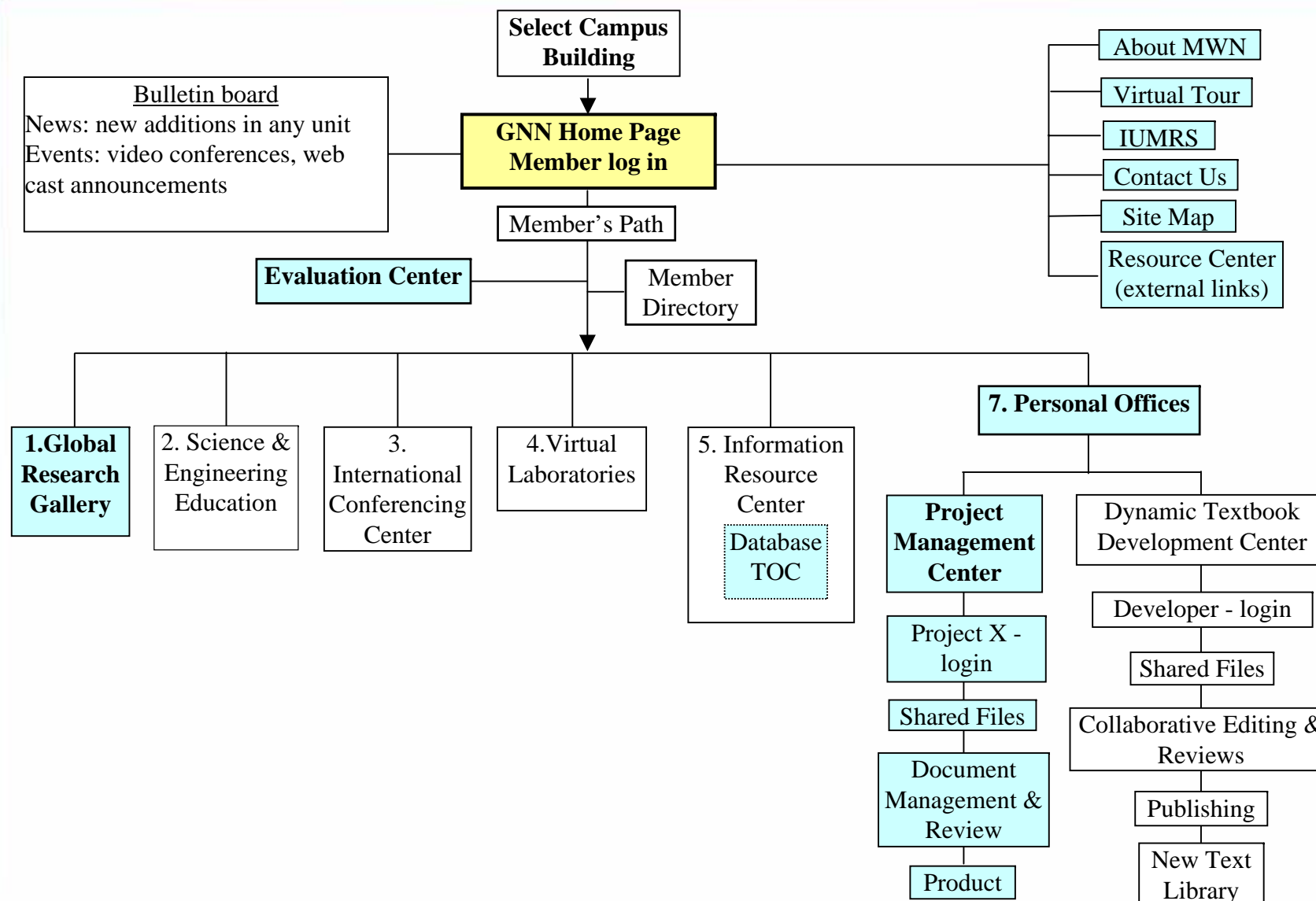


# International Virtual Institute (IVI) Concept

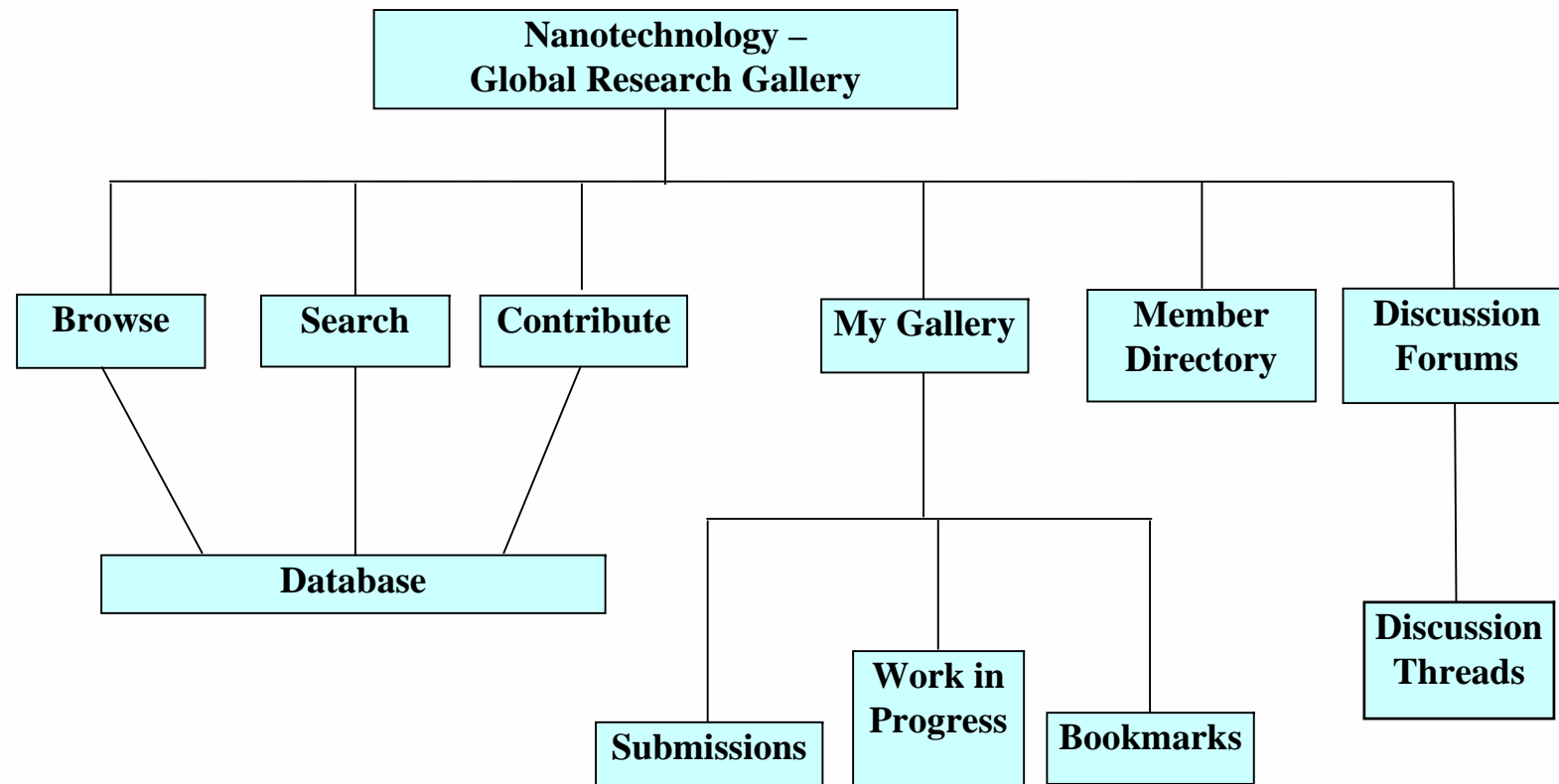
## Features Overview:

- Global Research Gallery
- Personal Office/Project Management System
- International Conferencing Center
- Information Resource Center
- Virtual Laboratories
- Evaluation Center
- Others

# International Virtual Institute (IVI) Concept



# Global Research Gallery (GRG) Concept







# International Virtual Institute

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[IUMRS](#)
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**Choose Floor**

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[Information Resource Center](#)
[International Conferencing Center](#)
[Publishing Center](#)
[Personal Offices](#)
[Lobby](#)

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[Member Directory](#)

## Global Research Gallery

[Logout](#)

### Materials Science

[Browse](#)
[Search](#)
[Contribute](#)
[Directory](#)
[My Gallery](#)
[Discuss](#)

Select to view a poster by category and sub-category. More options are listed in the [Index Category](#).

Select Category:

Types of Materials

Select sub-Category:

Biomaterials

Go

Reset

[Browse FAQ](#)
[Index Category](#)

#### Types of Materials > Metals and Alloys

	Title	Author	Date
1.	<a href="#">Three Dimensional Reconstruction of Metallic Microstructures</a>	<a href="#">Dimitris Kammer</a>	01/31/2003
2.	<a href="#">Cybersteel 2020: Design of Blast-Resistant Naval Hull Plate Steel</a>	<a href="#">Arup Saha</a>	01/31/2003
3.	<a href="#">Design of Nanodispersion Strengthened TiNi-base Shape Memory Alloys</a>	<a href="#">Jin-Won Jung</a>	01/23/2003
4.			
5.			
6.			
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10.			

1-10 | 11-20 | 21-30 | 31-40 | 41-50 | 51-60 | 61-70 | 71-80 | 81-90 | 91-100



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## Global Research Gallery

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### Materials Science

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**Basic Search** Select keywords in Index Category or enter keywords.

Keyword/s:

**Advanced Search** Search by title, author or research area.

Title:

Author:

Research Area:



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The information captured on this page enables the retrieval of the poster. You can return to edit each field before submission to the Gallery. This Gallery only accepts PowerPoint contributions.

Contribute FAQ

Index Category

1. Title of Poster:

2. Names of Authors:

\*Separate names by ";".

3. Research Area:

Types of Materials

4. Abstract:

Select Research Area

5. Keyword/s:

\*Separate keyword/s by ";".

6. References:

7. Upload file:

Browse

Upload the File

Save and Exit

Next

International Virtual Institute: Cyber-Infrastructure for the Global Nanotechnology Network

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## Global Research Gallery

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### Materials Science

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### Contributor Directory

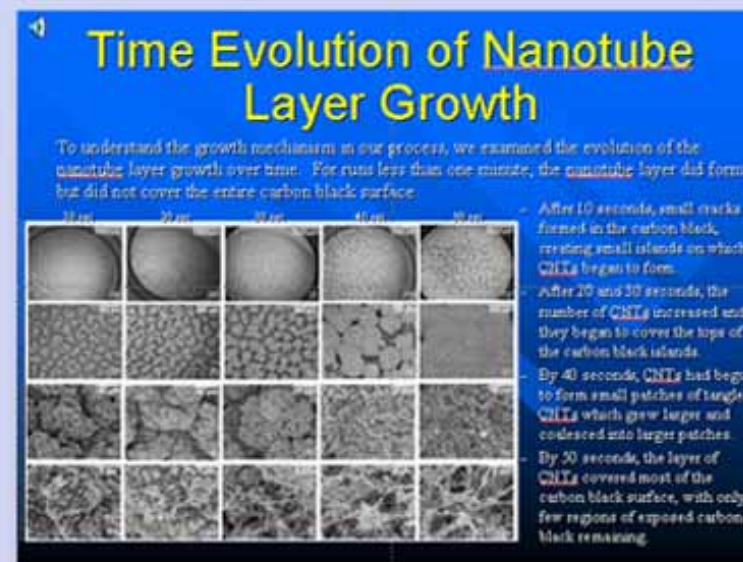
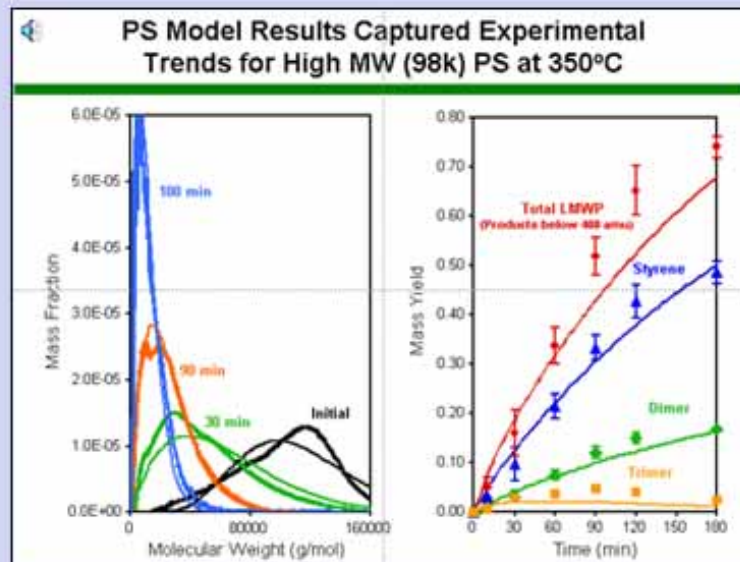
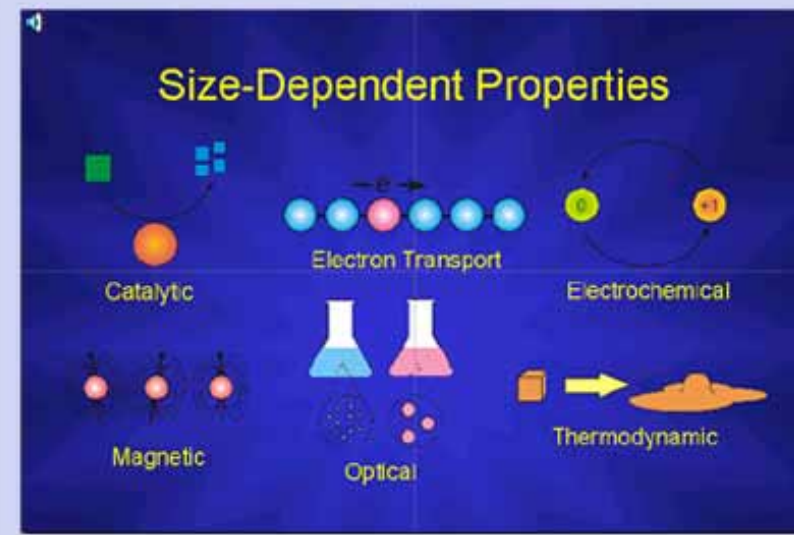
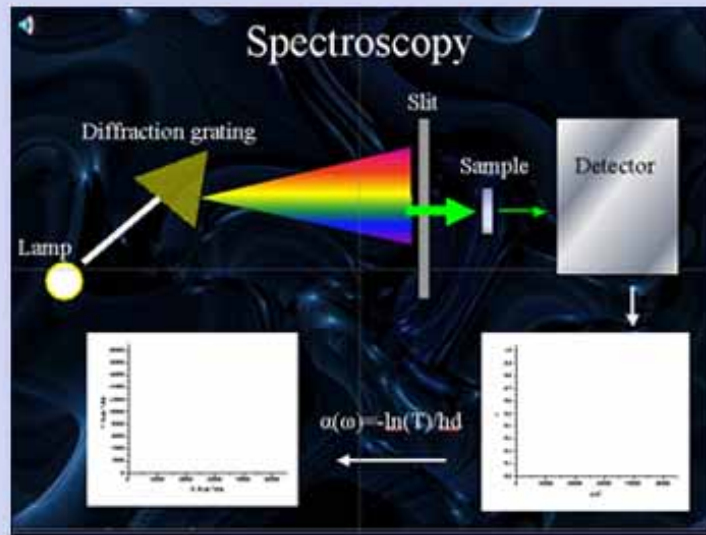
*Search by last name, institution and/or research area. Use the character "%" to indicate a wild card in name or institution. Keep in mind that each contributor enters their own institution so multiple phrasings of institution names are possible.*

Last Name:  Institution:

Primary Research Area:

[A](#) [B](#) [C](#) [D](#) [E](#) [F](#) [G](#) [H](#) [I](#) [J](#) [K](#) [L](#) [M](#) [N](#) [O](#) [P](#) [Q](#) [R](#) [S](#) [T](#) [U](#) [V](#) [W](#) [X](#) [Y](#) [Z](#)





# Global Research Gallery Concept

## Applications to the GNN:

- Support Research Collaborations
  - Display Current Research Results
  - Discussion Forums
  - Searchable Database
- Platform for Educational Exchanges
- Support Role as Nano Clearinghouse
- Etc....

# Conceptual Functions Under Development


- Personal Office
  - Project Management System
- International Conferencing Center
  - Video Conferencing, Workshops, Lectures
- Information Resource Center
  - Database
  - Publishing Function (Educational Content, etc...)
  - E-Library
- Virtual Labs & Equipment

# Personal Office

Document Management System - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Reload Search Address [http://www.materialsworld.net/ivi/offices/projects/project\\_list.jsp](http://www.materialsworld.net/ivi/offices/projects/project_list.jsp) Go Links »



**Choose Floor**

- Global Research Gallery
- Laboratories
- Information Resource Center
- International Conferencing Center
- Publishing Center
- Personal Offices**
- Lobby

**Evaluation Center**


**Member Directory**


File Drawer **Project Management Center** Messaging Notebooks Power Search


Project: [List](#) [Create](#)


[Click to view the icons](#)

## Project List

 **Purdue-NW-STC Proposal Prep** (Manage)  
[View Project Details and Member list](#)  
[Create a New Document](#)

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## Applications to the GNN:

This system will allow GNN members to collaborate on:

- Research Proposals
- Planning Documents
- Journal Articles
- Educational Content
- Etc.

# International Conferencing Center Concept

## Multiple levels of interactive Video communication:

- The 1<sup>st</sup> level uses the Access Grid
- The 2<sup>nd</sup> level of video communication integrates video conferencing with the Access Grid, using H.323 over IP, H.320 over ISDN dial-up
- The Access Grid is an internet-based communication system allowing groups to collaborate at a distance using:
  - Rich audio
  - Multiple video streams
  - Presentation resources



# International Conferencing Center Concept



# International Conferencing Center Concept

- Access Grid Nodes are located throughout the world, primarily at:
  - Research universities
  - National laboratories
  - Corporate research divisions
- In the early stages of its expansion, the AG already has more than 150 sites worldwide
- To find a node in your region, visit :
  - US: <http://www.accessgrid.org>
  - Europe: <http://euroag.accessgrid.org/>
  - Asian Pacific: <http://www.ap-accessgrid.org/>



# International Conferencing Center Concept

## Additional Modes of Conferencing:

- Webcast with RealVideo/MS Media Server
- Web conferencing
- Audio conferencing linked with video conference
- Integrated solution between some of the above

# International Conferencing Center Concept

## Applications to the GNN:

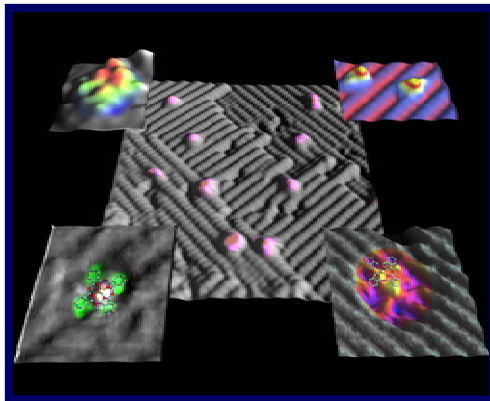
- Network Development
- Research Collaborations
- Educational Exchange
- Ongoing Network Management
- Etc...

# Information Resource Center

- Information repository & knowledge management center for the IVI
- Database index in Nano topics
- E-library: access to on-line journals, etc.
- Publishing function: members can write individually or collaborate with other members on journal articles, educational content, etc...

# Nanotech Course Development

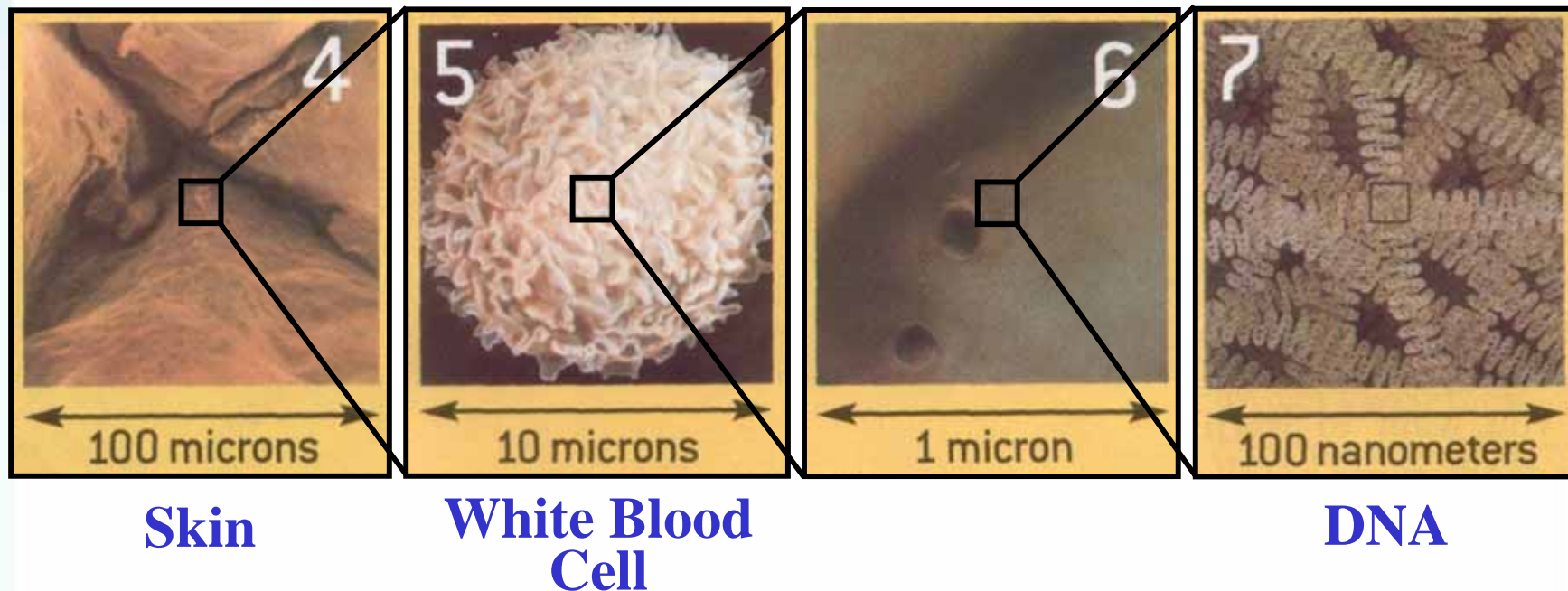
## Materials Science and Engineering 395: NANOMATERIALS



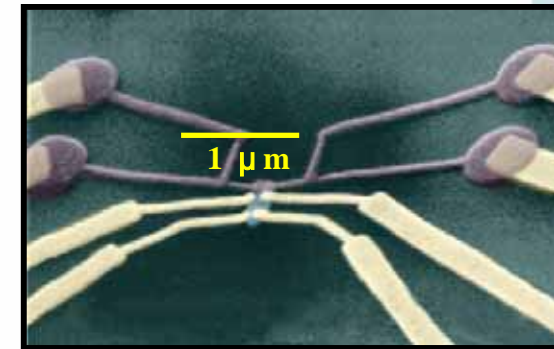
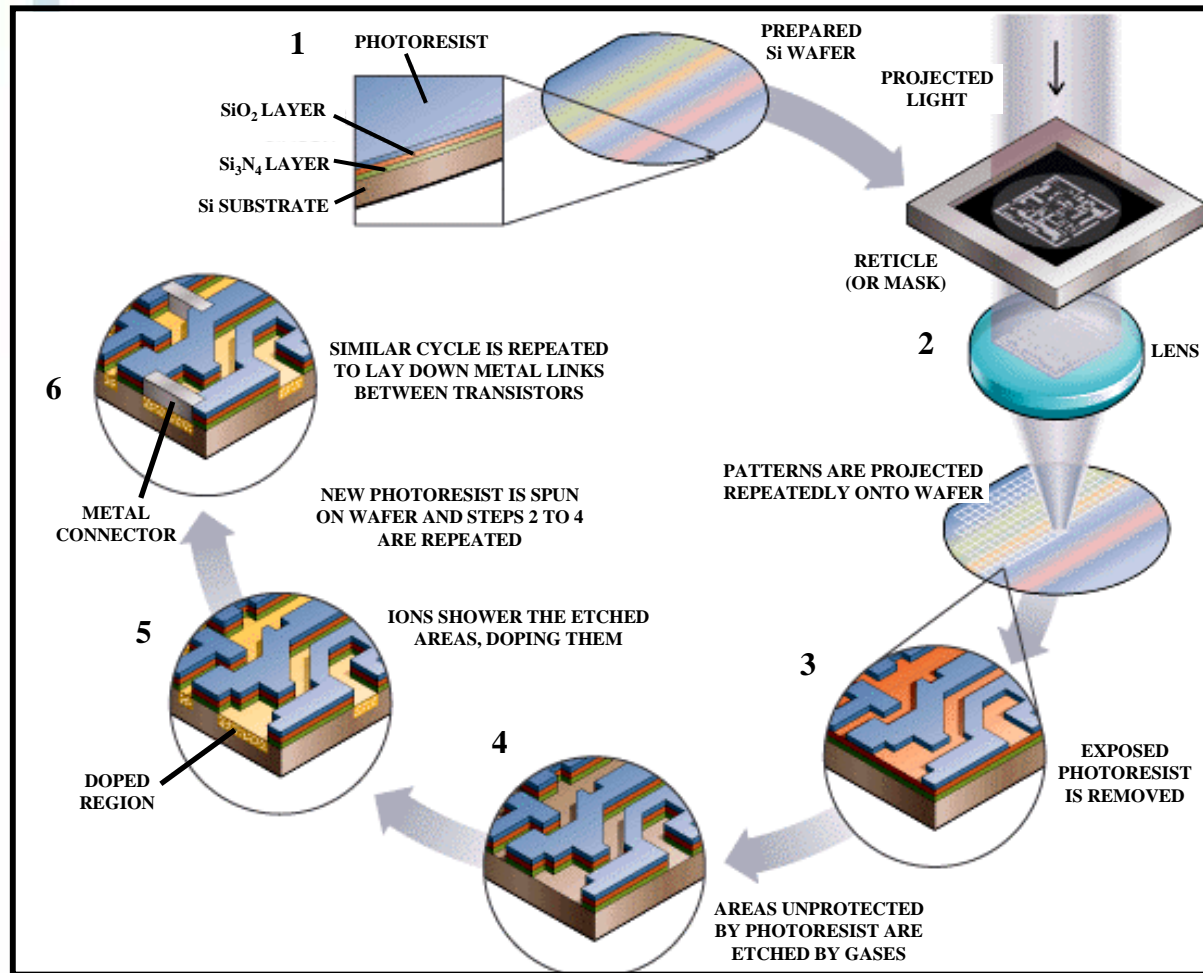
**Mark C. Hersam**  
**Assistant Professor**  
**Northwestern University**

### What is a Nanometer?

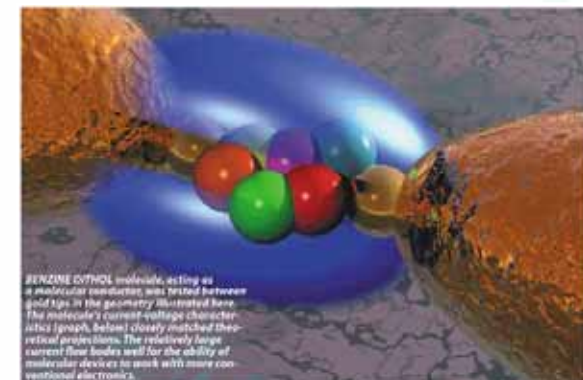
Consider a human hand:



## Beam Lithographies



Ferromagnetic/superconducting devices (e-beam lithography)

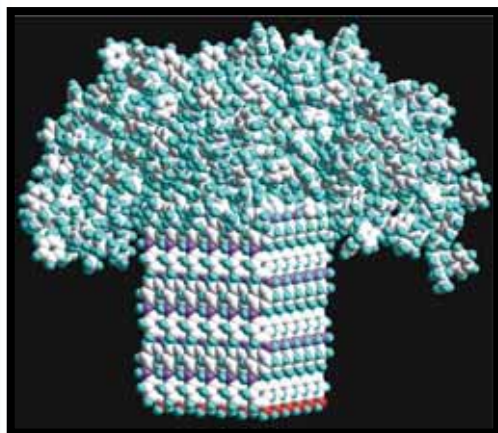


Molecular electronics (e-beam lithography)

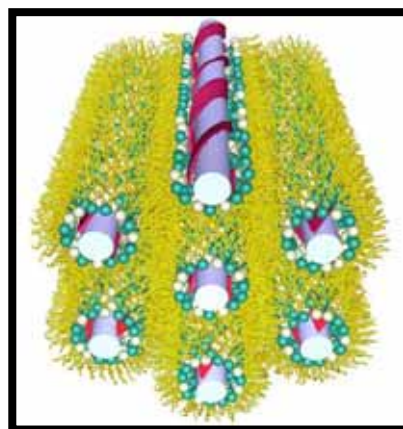


### Molecular Self-Assembly

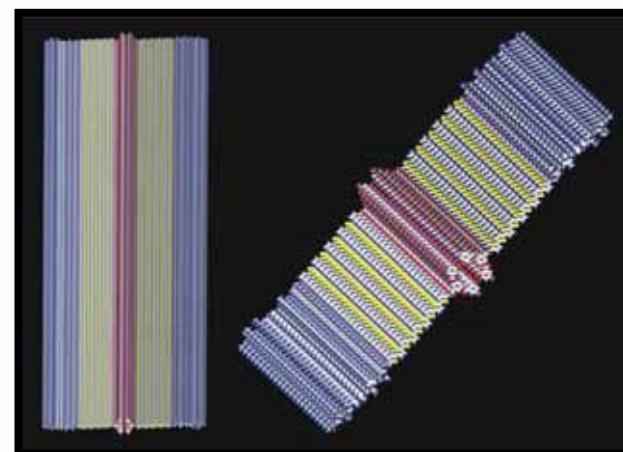
- Spontaneous organization of molecules into stable, structurally well-defined aggregates (nanometer length scale).
- Molecules can be transported to surfaces through liquids to form self-assembled monolayers (SAMs).



Supramolecular rodcoil  
“mushrooms”



Polythiophene wires



Supramolecular rodcoil  
nanoribbons

# Examples of Collaborations

The IVI has supported active collaborations between Northwestern University and other US & overseas institutions.

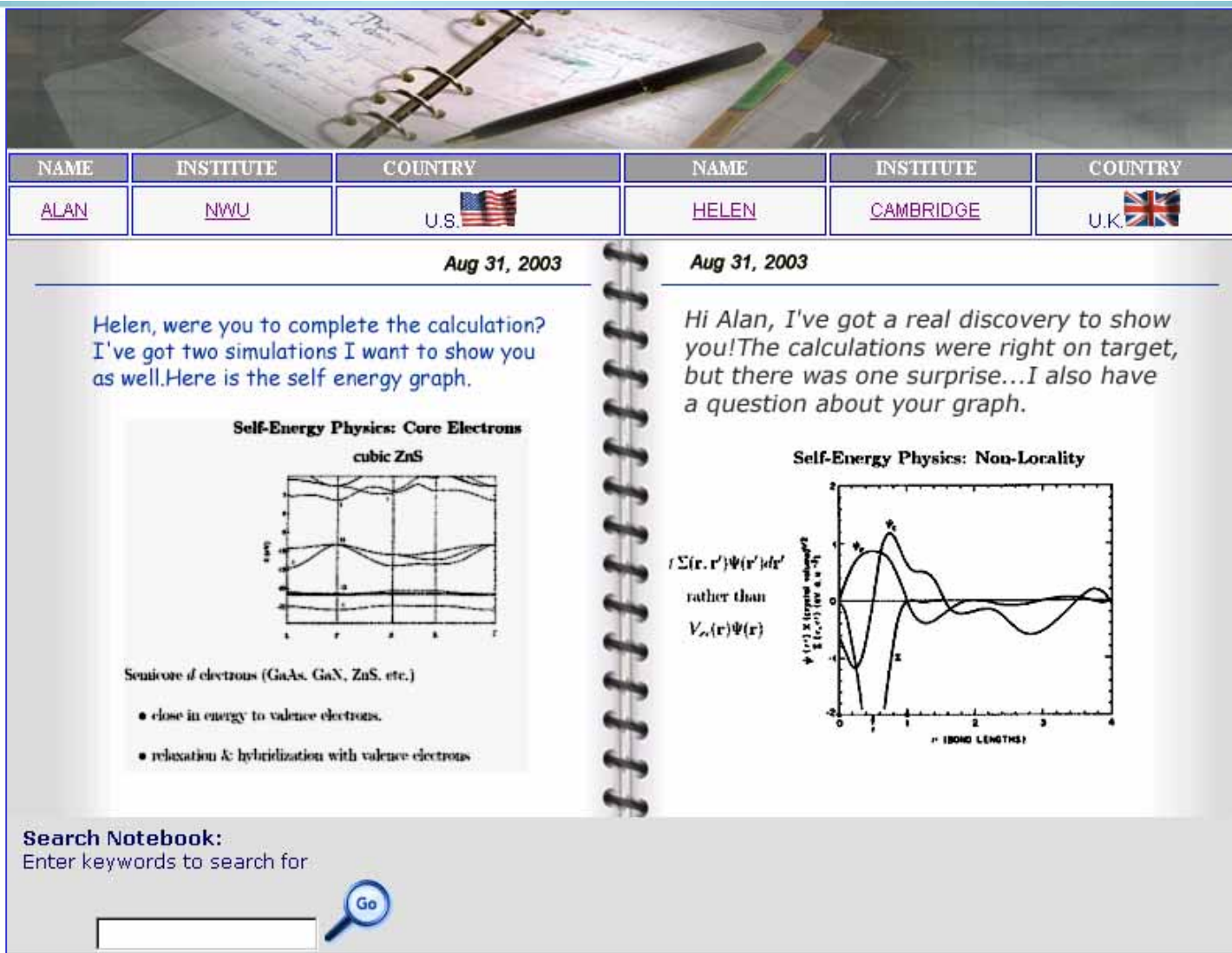
- Video conferences
- Joint research project planning
- Joint proposal preparations
- Student exchanges
- Joint course development
- Shared lab notebooks support long-distance facilities sharing





# Examples of Collaborations

The screenshot displays the 'Nanotechnology Research' website. At the top, a navigation bar includes links for 'Welcome', 'INAC', 'NCN', and 'nanoHUB'. Below this, the 'NCN' (Network for Computational Nanotechnology) section is featured. It includes a list of partner institutions: Purdue University, Northwestern University, University of Florida, University of Illinois, Morgan State University, and Stanford University. A search bar with the text 'Search Google' is also present. The main content area for NCN has a left sidebar with a 'Navigation' menu (Home, Program, Research, Partners, Education, Facilities, HPC, Jobs, Contact Us, Visit Us) and a central banner titled 'The Network for Computational Nanotechnology' with a molecular structure image. To the right of the banner is a 'Director's Message' from Mark Lundstrom, NCN Director, with a photo and a quote: 'The Network for Computational Nanotechnology (NCN) has a three-part...'. Below the NCN section, the 'nanoHUB' logo is displayed with a navigation bar (Welcome, INAC, NCN, nanoHUB). Further down, the 'INAC' (The NASA Institute for Nanoelectronics and Computing) section is shown. It has a similar layout with a navigation menu (Home, Program, Research, Opportunities) and a banner titled 'The NASA Institute for Nanotechnology and Computing'. To the right of the INAC banner is a 'Director's Message' from Supriyo Datta, INAC Director, with a photo and a quote: 'Within a decade or so, silicon transistor...'. The bottom of the page features a large 'nanoHUB' logo with the text 'Operated by the Purdue Computational Electronics Research Group' and 'The Nanotechnology Simulation Hub Online Computing for Nanotechnology'.

# Virtual Labs and Equipment

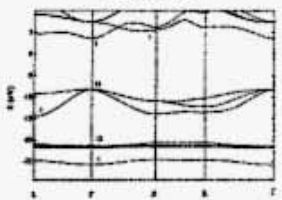


NAME	INSTITUTE	COUNTRY	NAME	INSTITUTE	COUNTRY
ALAN	NWU	U.S. 	HELEN	CAMBRIDGE	U.K. 

Aug 31, 2003

Helen, were you to complete the calculation? I've got two simulations I want to show you as well. Here is the self energy graph.

**Self-Energy Physics: Core Electrons**  
cubic ZnS



Semiconductors (GaAs, GaN, ZnS, etc.)

- close in energy to valence electrons.
- relaxation & hybridization with valence electrons

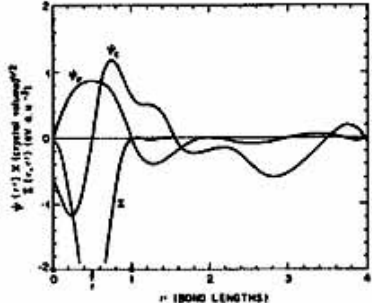
Search Notebook:  
Enter keywords to search for



Aug 31, 2003

Hi Alan, I've got a real discovery to show you! The calculations were right on target, but there was one surprise... I also have a question about your graph.

**Self-Energy Physics: Non-Locality**



$i \Sigma(r, r') \Psi(r') / dr'$   
rather than  
 $V_{sc}(r) \Psi(r)$

**R&D collaboration via shared lab notebooks.**

# Evaluation Center Concept

## Established Evaluation Guidelines:

- Front-end Analysis
- Formative Evaluation
  - Internal testing and focus group field tests.
  - Generate feedback through annual meetings and workshops
  - Launch Prototype IVI will generate more feedback from the materials community in all sectors.
- Summative Evaluation

## Evaluation Center Concept

This evaluation process will help the GNN to:

- Continue our dynamic development process
- Involve a large cross-section of community in field tests and development of services
- Ensure ongoing quality assurance
- Implement innovation

# Conclusion

The IVI can serve as a practical and effective cyber-infrastructure for GNN:

- Development
- Activities & Services
- Evaluation
- Evolution

# Plans & Implementation

- Submit research posters to the GRG
- Consult IVI for workshop report after this workshop
- Use IVI to continue our interactions here
- Visit Evaluation Center and give us your comments
- Participate in the development of the IVI

Effective November 1, 2003,  
please e-mail us at  
[mri@northwestern.edu](mailto:mri@northwestern.edu) to obtain  
a log-in ID for all the above items.



# Discussion Points

- Experience with existing networks
- Desirable features
- Cyber-infrastructure
- Real space infrastructures
- Potential benefits of a GNN
- Identify regional collaborators
- Strategic questions
- Plans for the next workshop in Europe