NanoScience Outreach

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Abstract for DBER Group Discussion on 2012-11-08

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Professor and Vice Chair, Department of Physics and Astronomy
Director of Education and Outreach, Nebraska Center for Materials and Nanoscience

Title:
Nanoscience Outreach

Abstract:
Informal science education is an important and rewarding activity for scientist and scientists-in-training. We are fortunate at the University of Nebraska to have over 90 of faculty research group working with materials and nanoscience, and involving hundreds of students, post-docs, and visitors. Some of us have banded together to develop an extensive nanoscience outreach effort that reaches nearly every corner of our community, with activities in a wide range of venues – in the schools, at the mall, at summer camps, with civic groups, at Science Cafés, at the Big Red Road Show, and many others – wherever you might find people who are curious about science. We reach hundreds of Nebraskans each year and think that we are having a significant impact on science literacy, as well as helping to recruit future STEM professionals. We hope that some of our experiences, both successful and not-so-successful, will show how you can contribute effectively to informal science education, often for a very small investment of time and effort. This work is done under the substantial sponsorship of the Nebraska Center for Materials and Nanoscience, and with support and encouragement from our own departments, the National Science Foundation, Nebraska EPSCoR, and professional societies. For more information on these and other activities, surf on over to http://www.unl.edu/ncmn/outreach/index.shtml
NanoScience Outreach

Stephen Ducharme
Professor and Vice Chair
Department of Physics & Astronomy
Nebraska Center for Materials and Nanoscience
University of Nebraska

Motivations
Activities & People
Resources
1 nanometer (nm)
One Billionth of a Meter

Human, approx.
2 Billion nm tall

Buckyball 1 nm

Nanoscale: 1 nm to 500 nm

Nanotechnology Size Comparisons

Nanopedia, Case
Western Reserve University
Motivations

People are interested about Nanoscience and Nanotechnology

- **Curiosity: What is it?**
  - Materials behave differently at the nanoscale
  - We have very powerful tools
  - An exemplar of the Scientific Process

- **Outlook: Will it help?**
  - We now have exquisite control of matter at the nanoscale
  - There are products on the market
  - Medicine, solar energy, foot odor, electronics, cosmetics…

- **Fear: Will it hurt?**
  - Nanoparticles can be hazardous
  - Fear of the unknown & unfamiliar
  - Grey Goo, Nano-bots, and the Borg
The 3 Cs ... Clothing!

- **Silver Nanoparticles** 19 nm across have antimicrobial properties.

- They make ArcticShield™ Socks odor and fungus resistant.
Motivations

UNL research is at the forefront Nanoscience and Nanotechnology

• Inherently Multidisciplinary
  ▪ Chemistry, Physics, Biology
  ▪ Engineering, Mathematics
  ▪ Entrepreneurship, Agriculture

• Evolving Research Emphasis
  ▪ We now have exquisite control of matter at the nanoscale
  ▪ There are products on the market
  ▪ Medicine, solar energy, foot odor, electronics, cosmetics…

• Centers and Large Projects
  ▪ Nebraska Center for Materials and Nanoscience (75+ faculty)
  ▪ New Nanoscience Building
  ▪ Several research grants of over $5 M
  ▪ Nebraska EPSCoR, MRSEC, other …
nanobits... Biological Nanostructures

Seven levels of hierarchical structure in bone.

Piezoelectric Tissues
- Bone
- Dentin
- Collagen

Prof. Alexei Gruverman, UNL Department of Physics and Astronomy
nanobits... Designer Nanomaterials

Nebraska ICE

Gold NanoCages

Prof. Xiao Zeng, UNL Department of Chemistry
nanobits... Polymer Nanofibers

Yuris Dzenis, UNL Department of Engineering Mechanics
Activities

Nanoscience outreach knows no bounds…

• **K-12 Education**
  - Visits to area schools
  - After school science programs
  - Summer camps, tours
  - Curriculum development
  - Summer research internships
  - Workshops for current and future teachers

• **Informal and Lifelong Education**
  - Nanodays at the Mall
  - Museum Activities
  - Civic Groups, Science Café
  - Recruiting & Big Red Road Show
  - Nanoscience and The Arts
Resources: People & Toys

NISENet Training

NanoScience Outreach Fellows
The QSPINS MRSEC partners with community organizations to increase Science Literacy

Science Café
(Red 9 Club)

UNL Speakers Bureau
(Osher Life-Long Learning Center)

Sunday with a Scientist
(Nebraska State Museum)
NanoDays

Saturday, March 24, 2012
1 p.m. – 4 p.m.
Westfield Shopping Mall

In Partnership with:
NCMN
Nebraska
EPSCoR
NISE Network

9 activities
30 presenters
400 participants
K-12 Outreach

QSPINS partners with other UNL units to teach K-12 students nanoscience and recruit STEM majors

Lincoln Bright Lights

NCMN NanoCamp

Saturday Science

UNL Big Red Road Show
Diversity in K-12 Outreach

Achieving balanced diversity in STEM fields:

- Start early
- Promote curiosity
- Pave a clear path
- Prepare teachers
- Provide mentorship

2011 Summer Workshop for Science Teachers

NanoDays 2012

2011 Big Red Stars
Career Development

WoPHY11
Third Annual Conference for Undergraduate Women in Physics

Provide networking opportunities for undergraduate women

- Sponsored by MRSEC
- Organized by Axel Enders & Verona Skomski

80 participants
24 states
75 undergraduates
K-12

Nano Kits

Nanocamp

Nanodays

Sunday with a Scientist
nanobits... Solar Cells

NanoParticle Solar Cell
More surface area to harvest charge

High-School Teachers
NATS, Lincoln Public Schools,
Seward H.S, Papillion-La Vista H.S.

Greg Smestad
SolIdeas.com

Q-SPINS Materials Research Science and Engineering Center, NSF-UNL
UNL is rich with expertise and enthusiasm…

• Faculty and Staff
  ▪ Passionate about their research
  ▪ Creative explaining it in the classroom or at the mall
  ▪ Understand their obligations to society
  ▪ Often can’t shut them up…

• UNL Students
  ▪ Training future scientists to be outstanding communicators
  ▪ Training future communicators in nanoscience
  ▪ Relate well to their peers
  ▪ Nanoscience Fellow program
  ▪ Research Fellowships, UCARE
Resources

Facilities, Funds, and Infrastructure...

• UN
  - Service is recognized and rewarded
  - Nebraska EPSCoR, NCMN
  - Departments, Colleges, VCAA, VCR

• Funding Agencies
  - NSF, DOE, etc.
  - Prof. societies, Consortia
  - NISENet

• School Systems
  - Eager for help with science
  - After school & summer programs
  - Match making
Summary

Motivations

- All ages bring a combination of curiosity, outlook, and fear
- UNL is heavily invested in nano research

Activities & People

- There is a wide range of venues and audiences
- Scientists at all career stages learn to communicate and teach science

Resources

- UNL has a deep well of expertise and motivated people
- Funding trends (NSF, DOE), consortia (NISE Net)
Links

- http://www.unl.edu/ncmn/outreach-edu
- https://epscor.nebraska.edu/nestip.shtml
- http://physics.unl.edu/outreach/outreach.shtml
- http://www.nisenet.org