

NISE Network SE Regional Meeting

Partner Presentations

September 11-13, 2013



Nano Mini-exhibition & RISE



- Center for the Environmental Implications of NanoTechnology – Duke University
- Marble Kids Museum
- University of Puerto Rico – Humacao and the Arecibo Observatory

More info: nisenet.org/catalog/exhibits/nano_mini-exhibition

Nano Mini-exhibition & RISE



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CEINT- NISE Net Partnerships

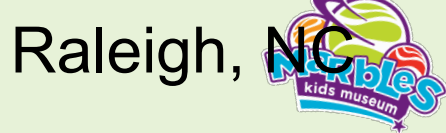
Glenda T. Kelly, Ph.D.

Associate Director for Assessment & Outreach

Center for the Environmental Implications of NanoTechnology- CEINT
Duke University



Marbles Kids Museum



MUSEUM of LIFE + SCIENCE

Children's Museum Pittsburgh

Kentucky Science Center



Who We Are

Center for the Environmental Implications of NanoTechnology-CEINT

Headquartered Duke University- funded 2008 +2013 NSF and EPA

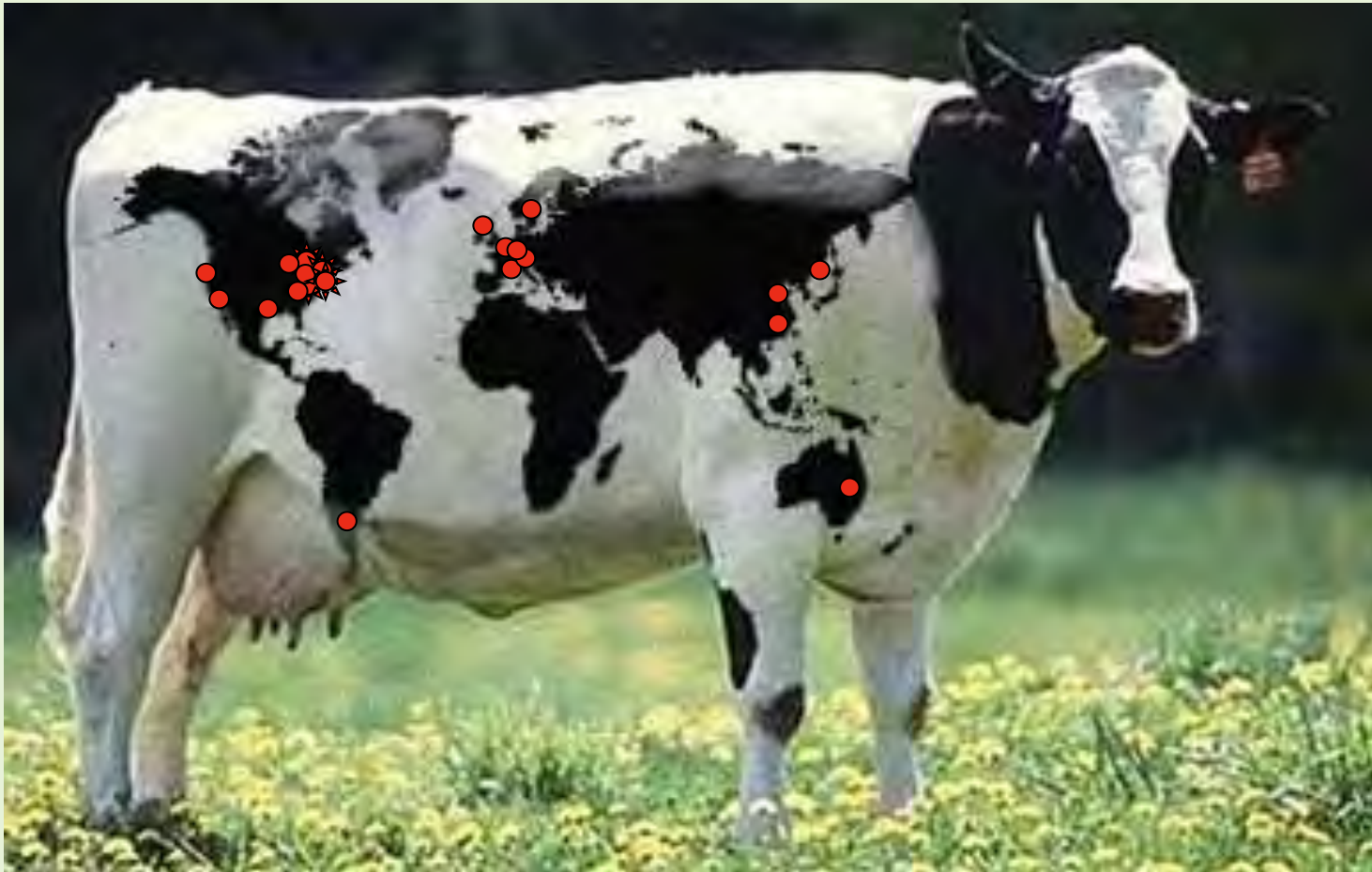
CEINT's Vision:

1. Elucidate principles that determine nanomaterial behavior in the environment
2. Translate findings into language of risk assessment
3. Provide guidance re assessing environmental implications of nanomaterials
4. Educate next generation scientist, engineers & general public



Over 19 International partners on 3 continents

- 4 core universities: Duke, CMU, Howard, Virginia Tech
- + University of Kentucky and Stanford
- 39 faculty currently supported, over 200 graduate +undergraduates





Materials Science & Technology



哈爾濱工業大學
HARBIN INSTITUTE OF TECHNOLOGY



서울시립대학교
UNIVERSITY OF SEOUL



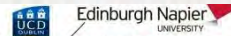
THE UNIVERSITY OF SYDNEY



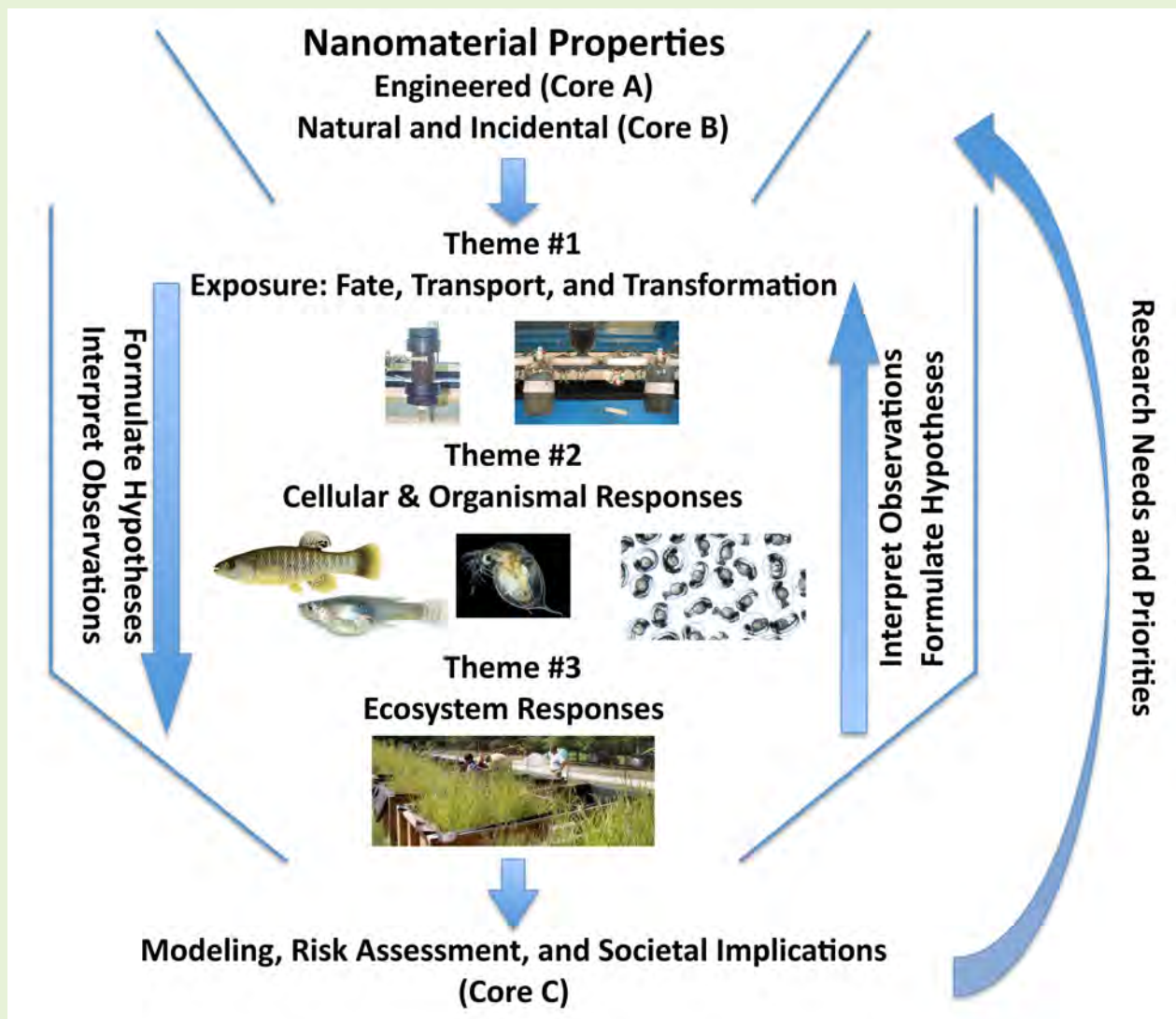
US Army Corps of Engineers
Engineer Research and Development Center



International Alliance for NanoEHS Harmonization



Research from Cellular to Ecosystem



4 CEINT- NISE Net Museum Partners

Museum Visitors Number > 17,396 NanoDays 2009-13

- 2009-current Museum of Life and Science, Durham NC
+ NanoNights- adult fun! Fall 2012
- 2010 expanded to Marbles Kids Museum, Raleigh NC.
+ NanoCamp summer 2012- led by our REU undergrads
- 2011 partnered Children's Museum of Pittsburgh-leadership Carnegie Mellon U
- **added Kentucky Science Center 2012**



NanoDays 2012: New Partner for Permanent Exhibit

CEINT U. of KY team partners with Kentucky Science Center, Louisville

- Activity- **simulates how nanoparticles bioaccumulate in animals**
- Center staff ask KY team to partner develop into permanent exhibit



Why research on environmental impacts matters?

Example activities: Museum of Life and Science Durham NC
NanoDays '09-'13

- CEINT investigator **Dr. Emily Bernhardt** & student/post-doc team added nanosilver from 15 commercial products to *E. coli* cultures



How does nanosilver impact fish development?

Nano Days '09- '13

NC Museum of Life & Science

- CEINT faculty and student research teams display aquarium of *medaka* and *killifish* & visuals from work on impacts of nanosilver on fish
- Why are medaka are used in research?



Why research on environmental impacts matters?

Example activities: Museum of Life and Science Durham NC
NanoDays '09-'13

- What are the roles of microorganisms in the environment?
- How could silver nanoparticles influence those roles?
- **CEINT researcher Dr. Ben Colman demonstrates helpful roles**



NanoToss: What Does Stickiness have to do with it? Let's try these coatings out!

Museum of Life & Science, Marbles Kids Museum & Childrens
Museum of Pittsburgh NanoDays 2011-13:



CEINT grad students: Amrika Deonarine & Tong
Zhang



Broad Dissemination

CEINT Educational Video on NISE Net Website and YouTube

Does Every Silver Lining Have a Cloud?



NanoDays Kits 2012: Over 300 US Museums

Credits: filming by Brad Herring of Museum of Life and Science Durham NC

1476 Online Views as of 12/5/12

CEINT- NISE Net Partnership Summary

- NanoDays
 - NanoNights
 - NanoCamps
 - NISE NET hosted CEINT Video for public
 - Activities demo importance of environ. research
 - Field trips- NISE Net museum educators & schools
 - Science Cafes
 - Partner on grants
- ➔ Marbles Kids Museum- STEM Play Corps Grant



Benefits to Research Centers/Universities

- Interested audiences- broad engagement, continuing use
- Great recruitment by museums for events
- Allows round robin of activities- show integrated research & importance
- Excellent support museum partners
- NISE NET TEMPLATES help students pitch level for science translation
- Our students highly rate importance to training
- Network facilitates national expansion across US
- Lays groundwork for future partnership grants

Acknowledgements

National Science Foundation (NSF), EF-0830093

Environmental Protection Agency (EPA)

NISE Network, National Science Foundation, DMR 0532536

Museum of Life and Science, Durham NC

Marbles Kids Museum, Raleigh NC

Children's Museum Pittsburgh PA

Kentucky Science Center

Thank you!

Nano Mini-exhibition & RISE



- Marble Kids Museum

More info: nisenet.org/catalog/exhibits/nano_mini-exhibition

Nano Play! at Marbles Kids Museum

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Nano Days

- Annual event
- An introduction to nanoscience and technology
- Draws 300 guests
- Partners facilitate activities from the Nano Days physical kits or their own activities
- Marbles staff and volunteers facilitate additional activities



Nano Dailies

- Deliver activities and materials from Nano Days physical kits and NISENet resources as part of ongoing facilitated science programming
- Kit activities and NISENet resources serve as a model for development of other content and for partner content development



Nano Play

- NISENet Mini-Grant funded initiative
- Lunch time nano exploration sessions integrated into regular summer camp program
- One 45 minute session per week
- ~75 campers, 10-15 staff and volunteer participants, and 6-8 partners each week



What's next?

- Nano-focused learning lab for students in grades 4-8 in conjunction with the documentary *Mysteries of the Unseen World*.
- Creation of a STEM Corps of middle school students to deliver STEM Play at Marbles and outreach events. First year focus will be nano.
- Nanoscience programming at the NC State Fair!



Partnerships

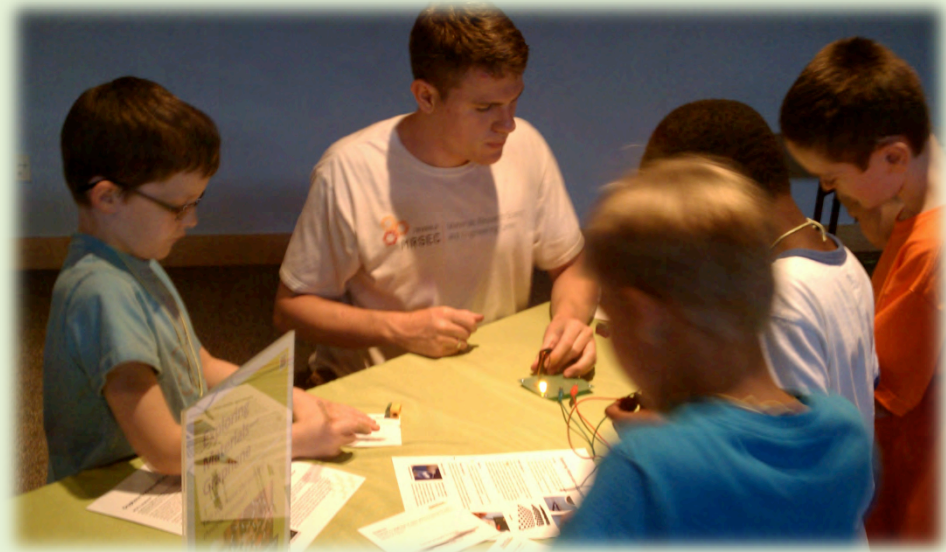


NANO@NC STATE



TRIANGLE
MRSEC

Materials Research Science
and Engineering Center



Nano Mini-exhibition & RISE



- University of Puerto Rico – Humacao and the Arecibo Observatory

More info: nisenet.org/catalog/exhibits/nano_mini-exhibition



"Nano" in Puerto Rico

Idalia Ramos, PREM UPR-Humacao

Teresa Brigganti, Casa Roig Museum

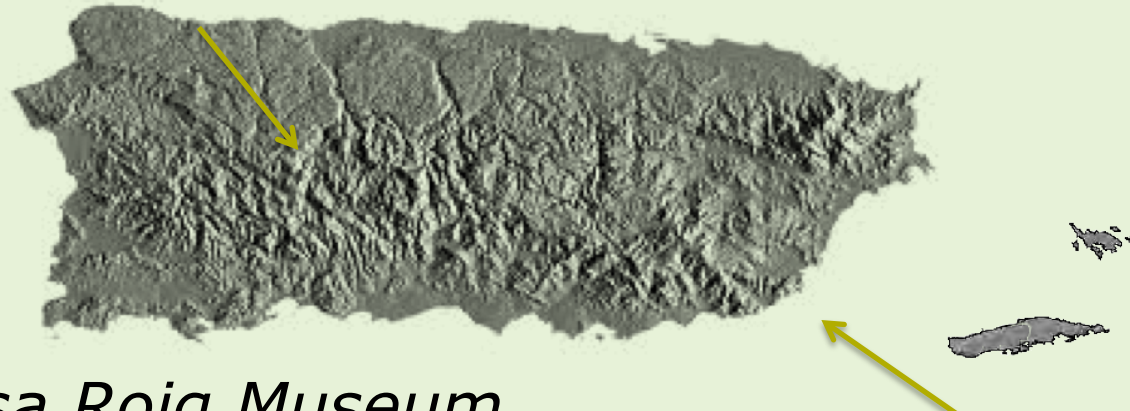
Hilda Colón-Plumey, Arecibo Observatory

Nano Exhibition Hosts



Arecibo Observatory

The William E. Gordon Telescope
d's largest single-aperture telescope
50th Anniversary 1963-2013



Casa Roig Museum

Prairie School-style house designed by
Architect Antonin Nechodoma
Built in 1920, restored by UPR in 1984



Integrating the Historic House to the Exhibition



The role of nanoparticles in the Stained Glasses and Mosaics of Casa Roig

Materials used in the Design and Construction of Casa Roig

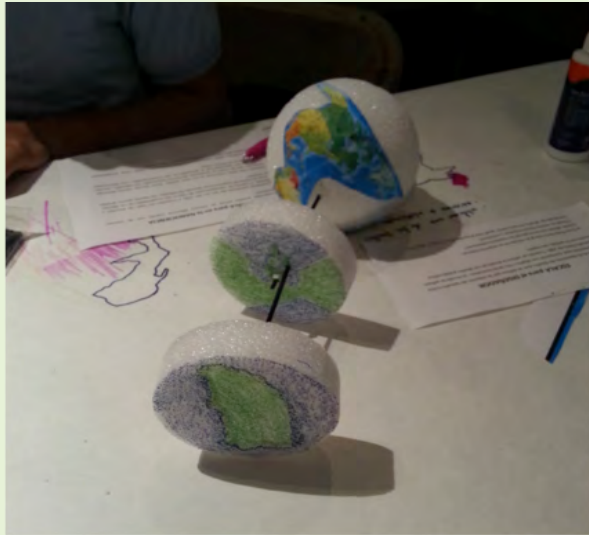


Nano at Casa Roig Museum



NISE Net Southeast Hub, Sep 11-13, 2013,
Durham, NC

Developing New Modules: Participatory Design



*Students from local schools
designing the modules.*

New Interactive Modules



Where can you find nano in Casa Roig?

Colors, Scales, and Materials in Casa Roig





Scales



NISE Net Southeast Hub, Sep 11-13, 2013,
Durham, NC



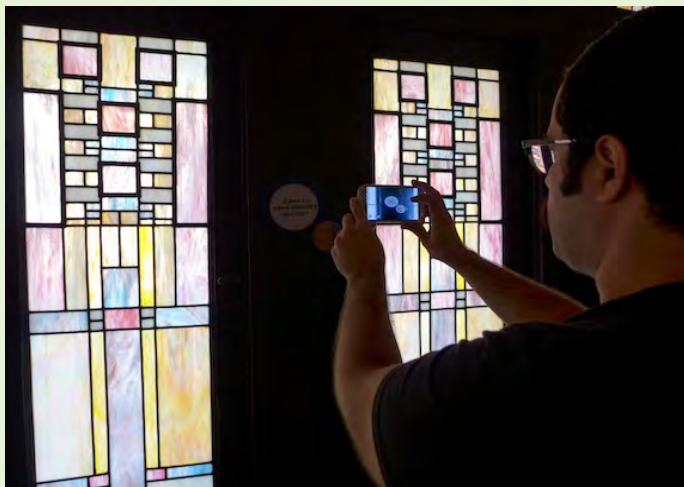
Materials



Size and Color



"Los Recovecos de Antonín" Antonín's Nooks and Crannies



Scavenger Hunt

Sep 11-13

Durham, NC

Collaboration Humacao-Arecibo



Collaborative Agreement between UPR Humacao and Metropolitan University of PR /Arecibo Astronomical Observatory to present Nano Exhibition (March 2013)

NISE Net Southeast Hub, Sep 11-13, 2013,
Durham, NC



ARECIBO OBSERVATORY
THE WILLIAM E. GORDON TELESCOPE
ARECIBO PUERTO RICO 1963 - 2013

"From Nano to the Cosmos"

March 2014



Angel Ramos Foundation Visitor Center

Mini-Grant Presenters



- Louisiana Art and Science Museum
- The Pink Palace
- James Madison University

Mini-Grant Presenters

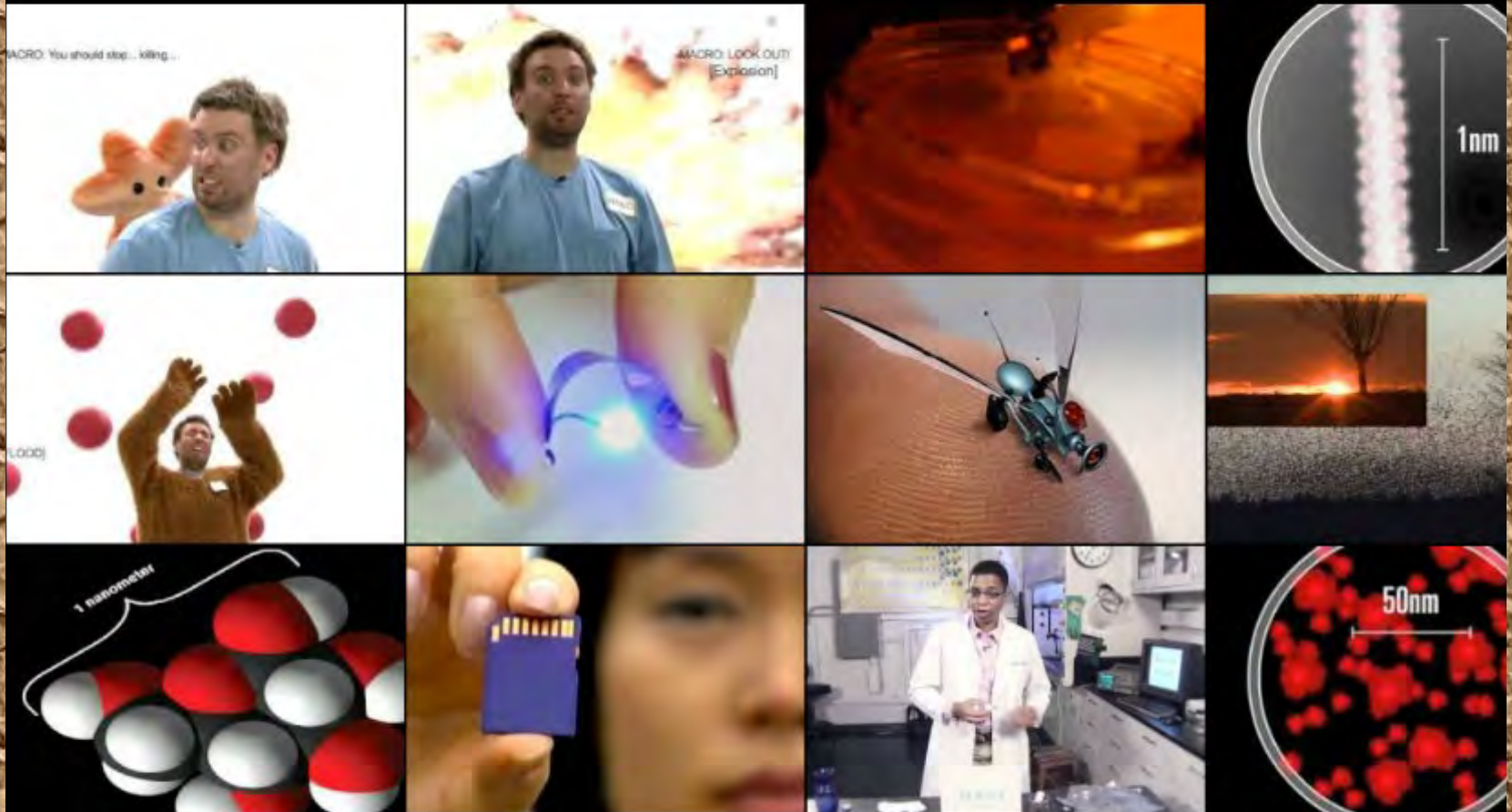


- Louisiana Art and Science Museum

A microscopic image of a textured surface, possibly a material at the nanoscale, showing a complex pattern of ridges and valleys. The image is predominantly blue with green highlights, giving it a glowing, ethereal appearance. The texture is irregular and organic, with some areas appearing more crystalline than others.

**We Know
NANO!**

Nano and Me - Gold (Director's Cut)



Nano is small and different

Nanoscale things are very small, and often behave differently than larger things do.

Macro:

A child is about 1 meter tall

1 meter = 1,000,000,000 nm

(1 billion nanometers)



Micro:

A red blood cell is about 10
micrometers wide
 $10 \text{ micrometers} = 10,000 \text{ nm}$
(10 thousand nanometers)



Nano:
DNA is about 2
nanometers
wide



NANOMETERS The prefix “nano” means one-billionth. So a “nano” of something is a billionth of the

whole—a very, very small fraction.

a billionth of a meter is a nanometer.

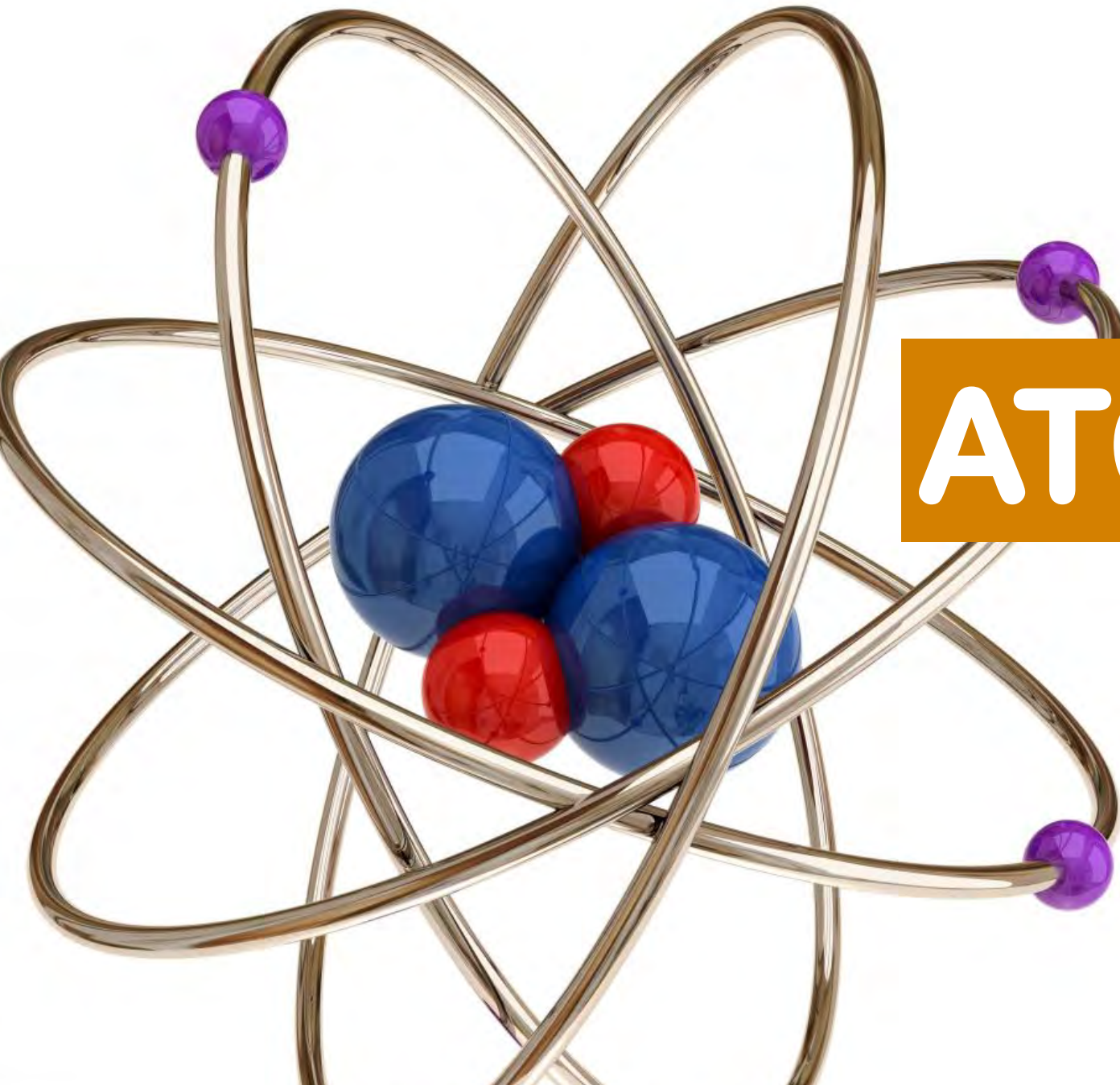
Nanometers are tiny, so we use them to measure tiny things like DNA (about 2 nanometers wide).

A Blue Morpho butterfly is about 12 cm wide

A ladybug is about $\frac{3}{4}$ cm long

1 centimeter = 10 million nanometers

A nanometer= one billionth of a meter.
($1/1,000,000,000$ or 10^{-9})

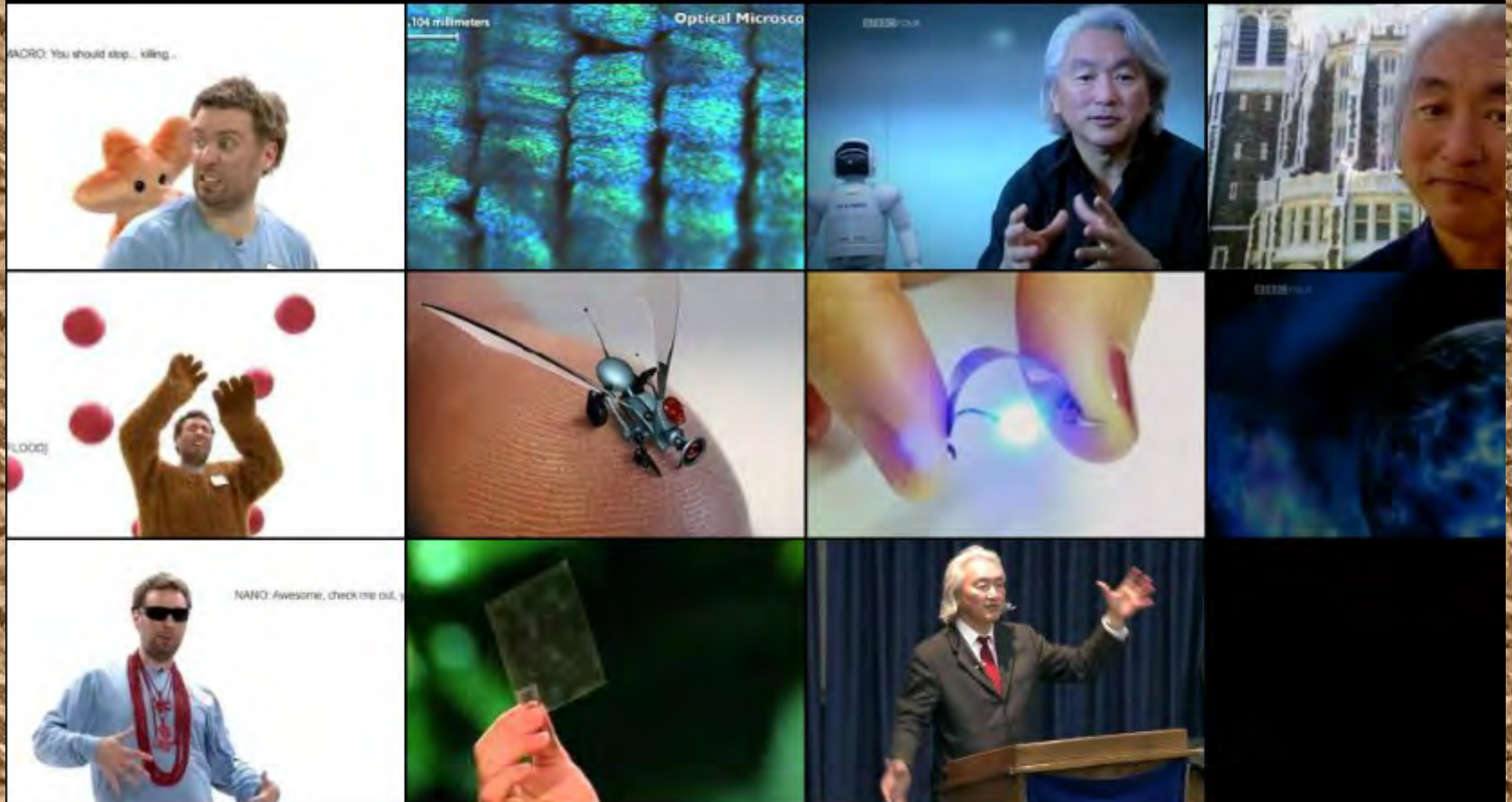


ATOMS

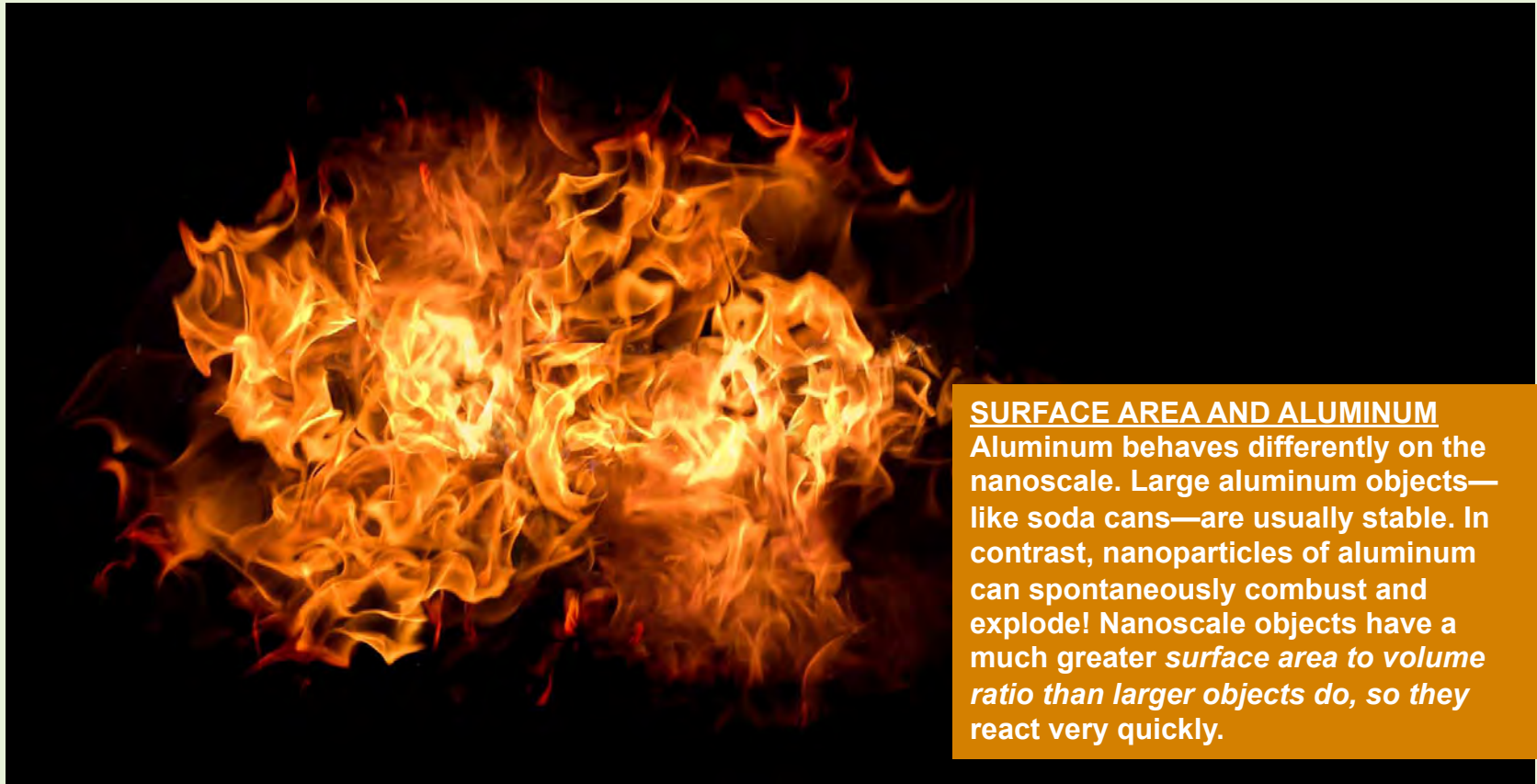
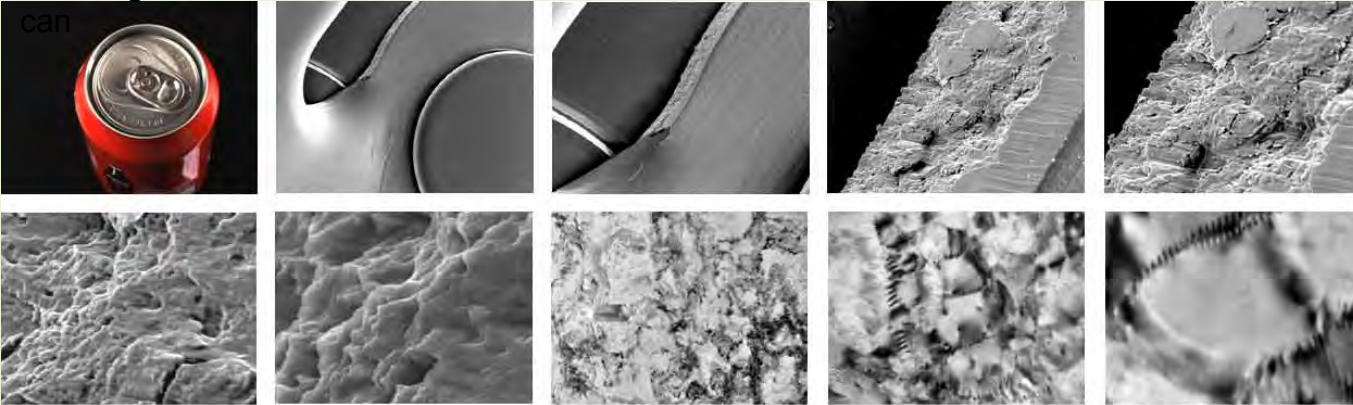
**Some materials
behave differently
at a small scale
than they do at a
large scale.**



Nano and Me - Aluminum (Director's Cut)



Zooming in on an aluminum



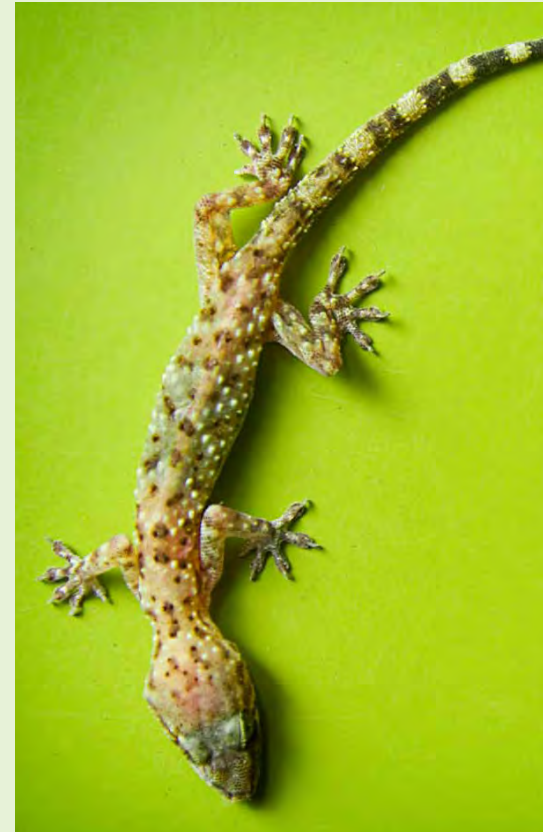
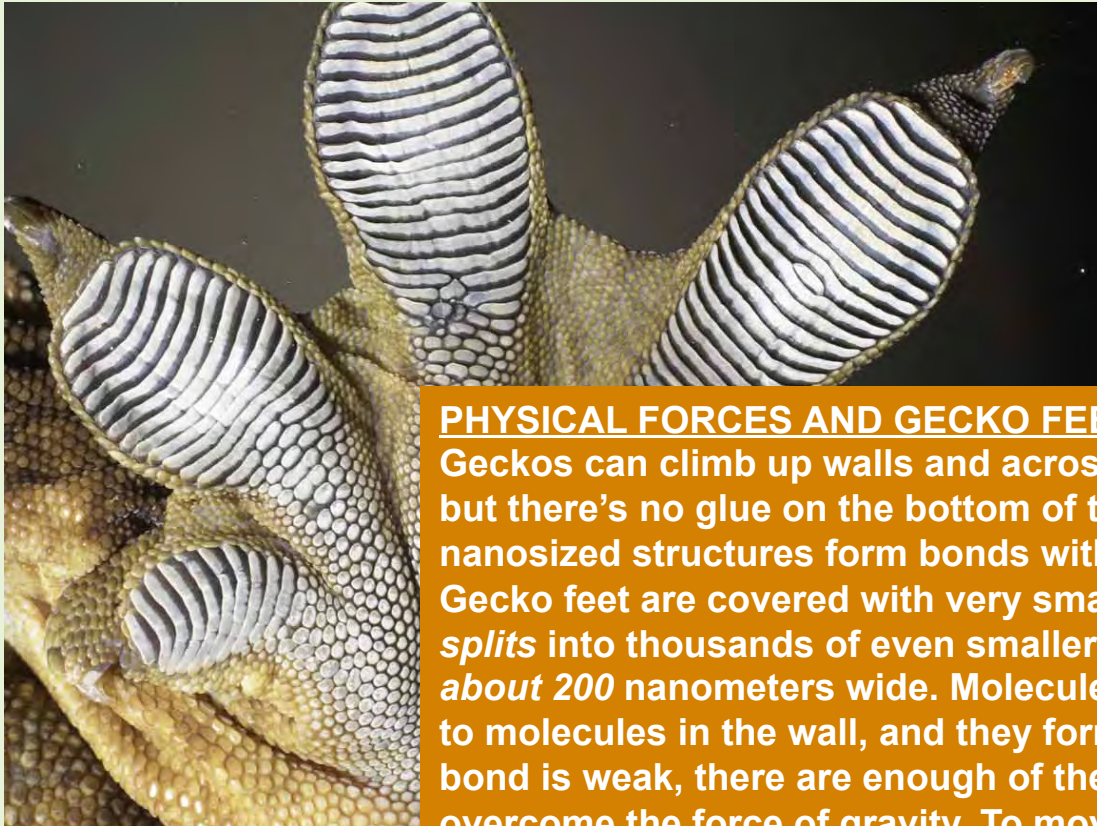
SURFACE AREA AND ALUMINUM

Aluminum behaves differently on the nanoscale. Large aluminum objects—like soda cans—are usually stable. In contrast, nanoparticles of aluminum can spontaneously combust and explode! Nanoscale objects have a much greater *surface area to volume ratio* than larger objects do, so they react very quickly.

A single “hair” from a gecko toe



Tiny “hairs” on a gecko toe

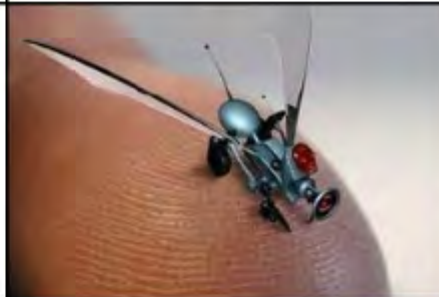


PHYSICAL FORCES AND GECKO FEET

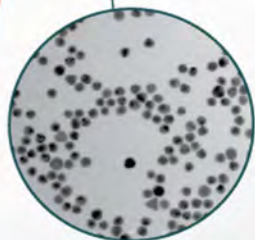
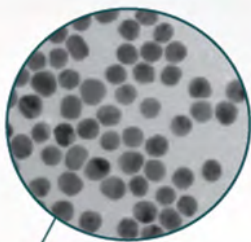
Geckos can climb up walls and across ceilings, but there's no glue on the bottom of their feet! Instead, millions of tiny nanosized structures form bonds with the wall.

Gecko feet are covered with very small “hairs” called *setae*. *Each one splits* into thousands of even smaller ends, called *spatulae*, *which are only about 200 nanometers wide*. Molecules in these “split ends” are attracted to molecules in the wall, and they form a temporary bond. Although each bond is weak, there are enough of them to allow intermolecular forces to overcome the force of gravity. To move, the gecko tilts its foot, breaking the bonds.

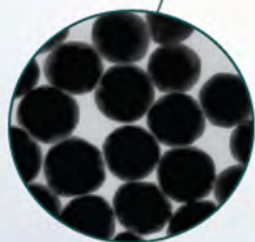
Nano and Me - Gravity (Director's Cut)



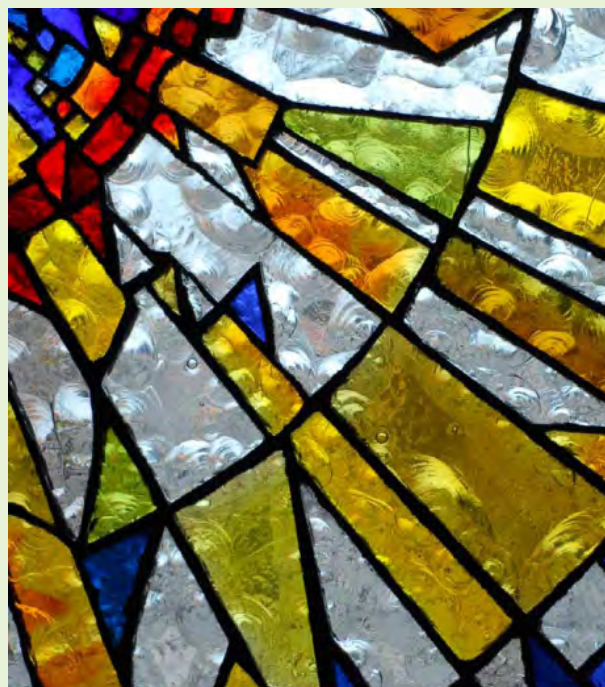
Pink stained glass
30 nm gold nanoparticles



Red stained glass
10 nm gold nanoparticles



Light orange stained glass
80 nm gold nanoparticles



SPIN TO WIN!



Nano is studying and making tiny things

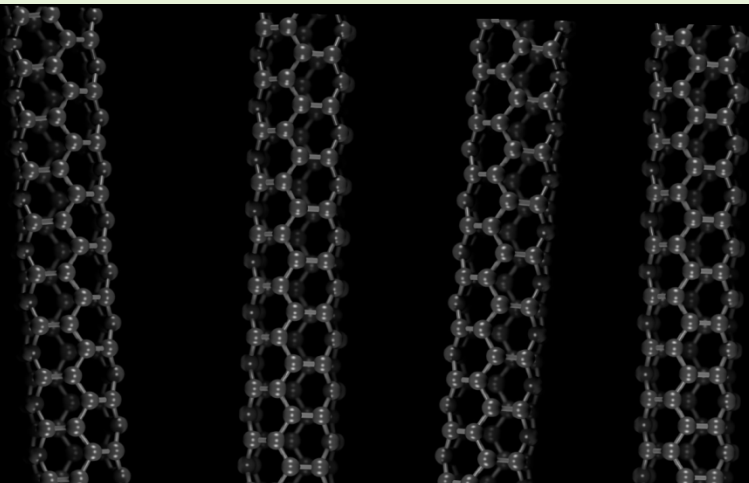
Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale.



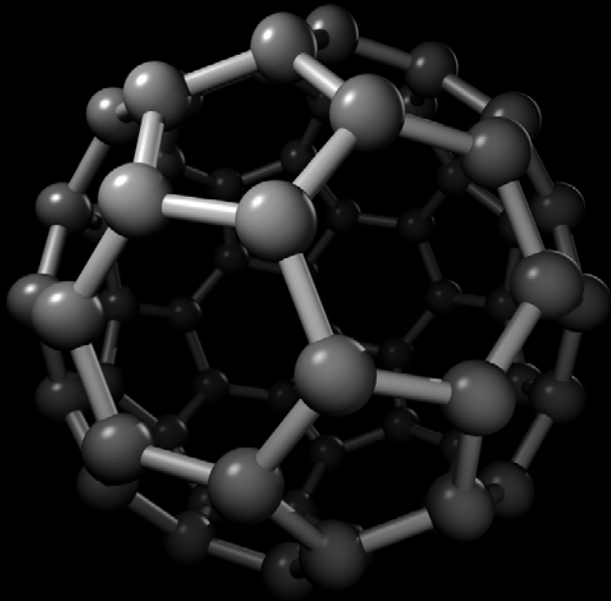
DIAMOND AND GRAPHITE

Carbon atoms can form diamonds, the hardest natural material known on Earth. But they can also form one of the softest materials, graphite (pencil lead). Both diamonds and graphite are made entirely from carbon. They have different properties because the carbon atoms are arranged differently. Diamonds are hard and shiny because they have a sturdy molecular structure. Graphite is soft and slippery because its carbon atoms are stacked in sheets.

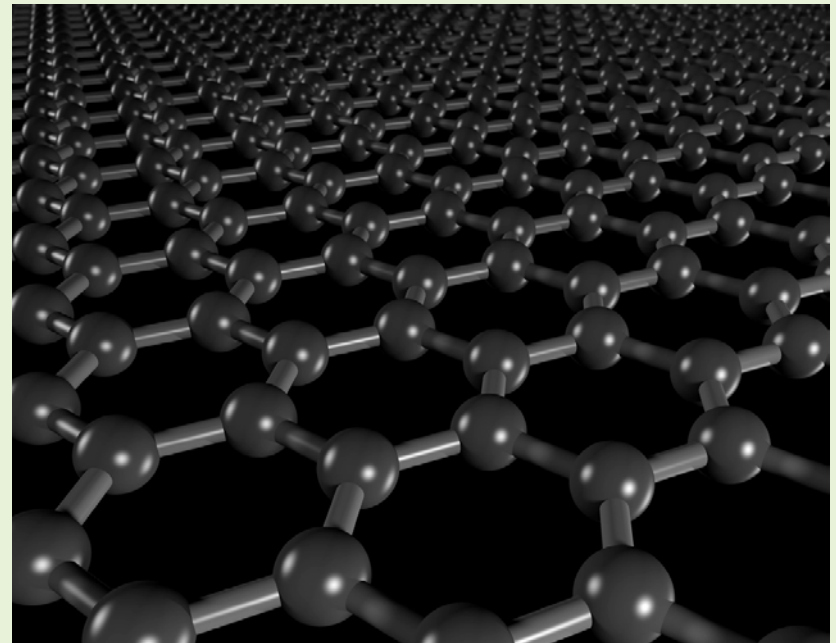




CARBON NANOTUBES are very strong and light, and can act as semiconductors or conductors. Researchers are studying ways to use carbon nanotubes in electronics, fuel cells, and other technologies.



BUCKYBALLS are good lubricants because of their spherical shape. Their hollow structure could make them useful for delivering medicine in the future.

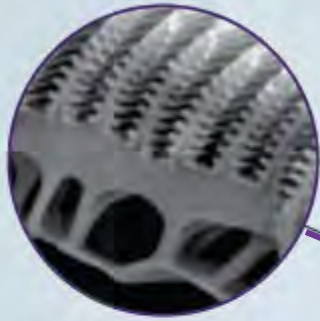


GRAPHENE is strong and flexible, and it conducts electricity and heat. Potential uses for graphene include integrated circuits in computers and sensors to detect gases.

**TOP
DOWN**



**BOTTOM
UP**

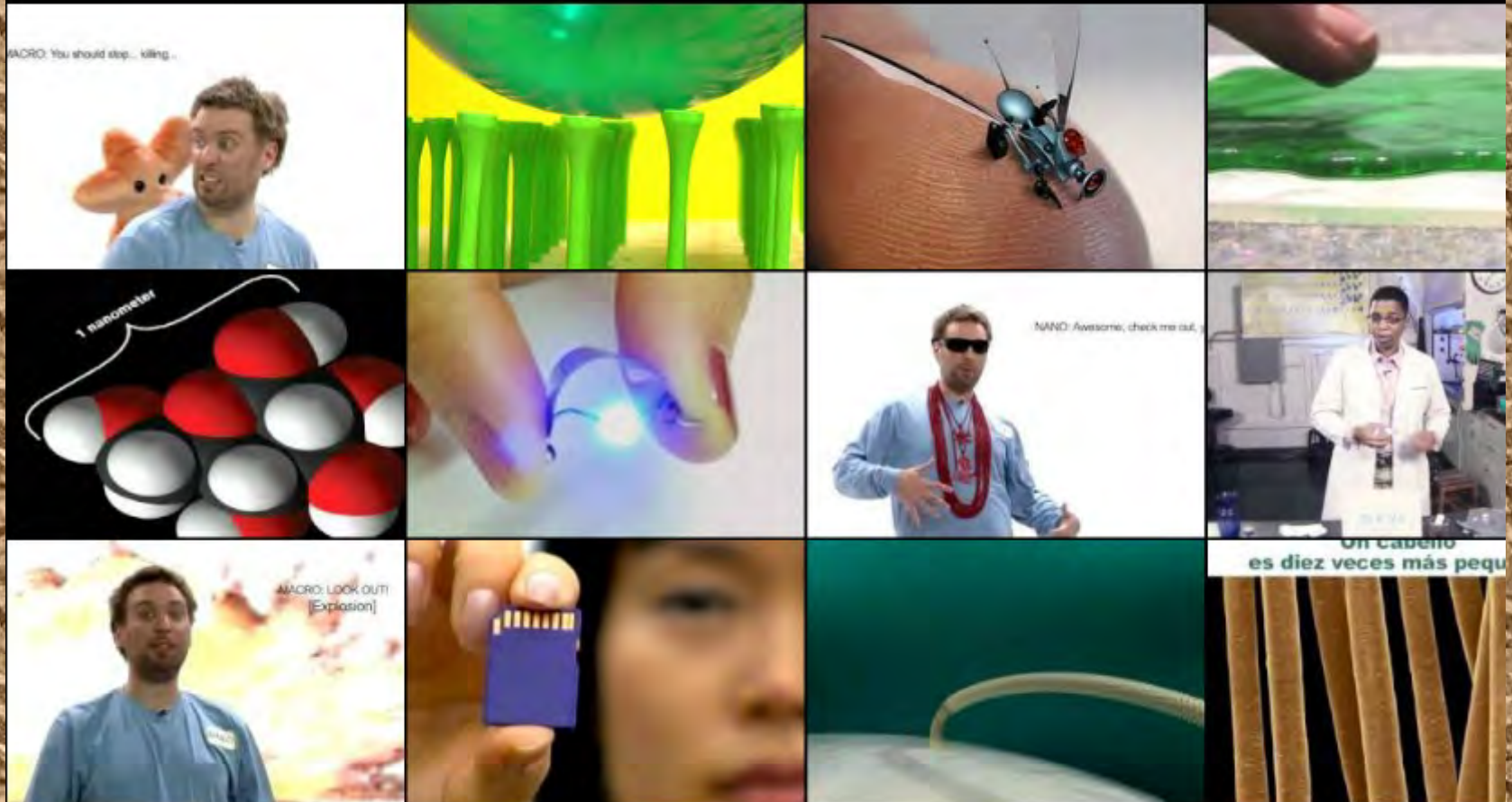


**Tiny nanostructures
on the scales of a
Blue Morpho butterfly**



**Nano is all around us –
in nature and in
technology.**

Nano and Me - Pants (Director's Cut)

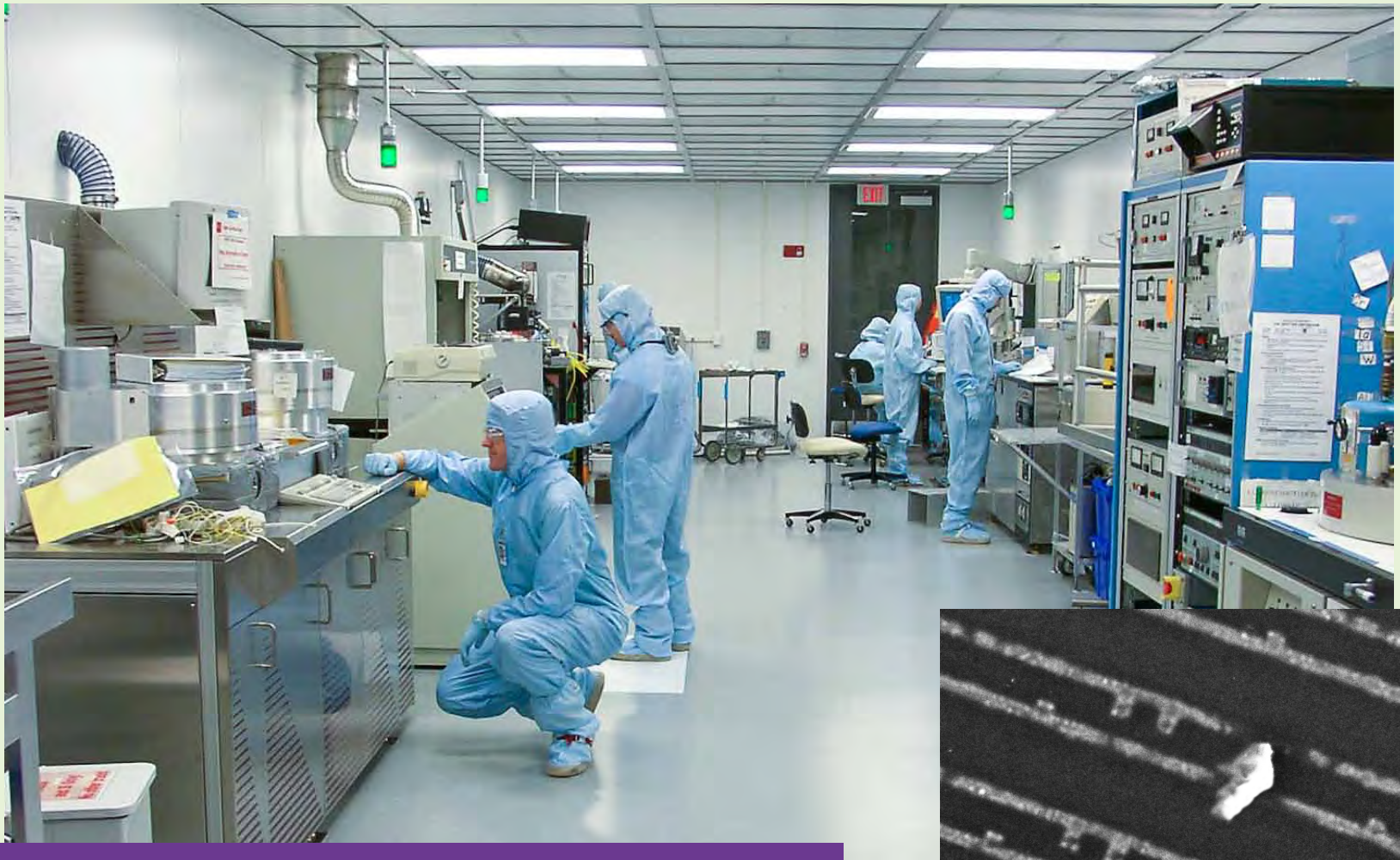




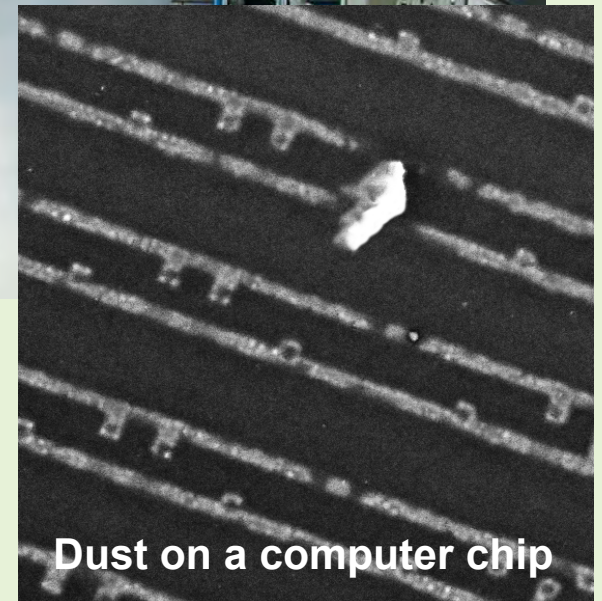
Water drops on a lotus leaf



Stain-resistant fabric



Nanoscale science, engineering, and technology are possible because of new tools and techniques.



Dust on a computer chip

Nano and Me - Latex (Director's Cut)



SPIN TO WIN!



Nano is new technologies

Nanoscale science, engineering, and technology lead to new knowledge and innovations that weren't possible before.



Researchers and engineers use nanoscale properties to improve and create materials, devices, and applications.

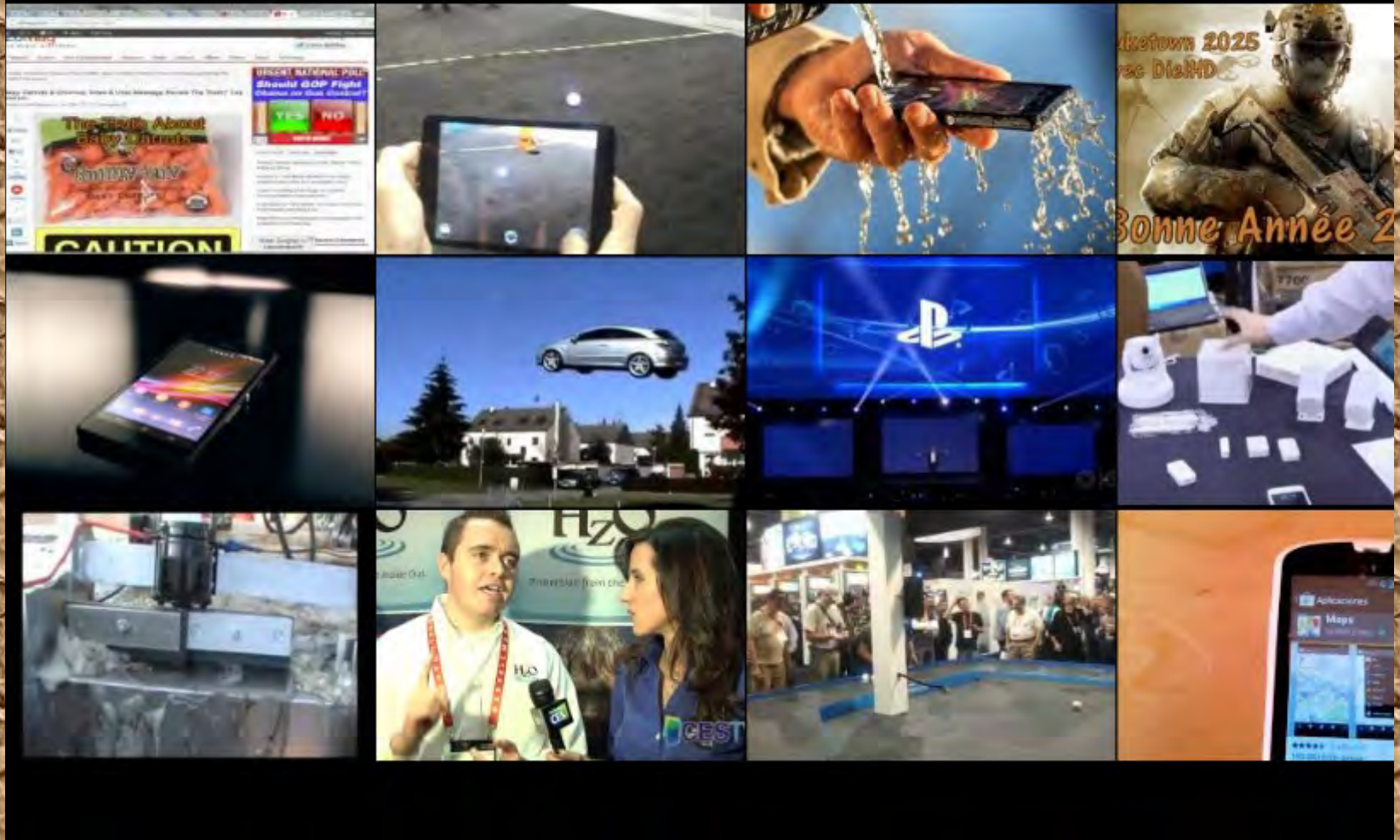
COMPUTERS

Computer chips contain tiny nanoscale parts. When you use a smartphone, laptop, gaming console, or any other electronic device with a chip, you're using nanotechnology.

Tiny switches called transistors give a chip its storage and processing power. A single chip might have two billion transistors!

Today, researchers are working with new nanomaterials to make even smaller transistors—and smaller, more powerful chips. In the future, nanotechnology might lead to entirely new kinds of ways to process information, revolutionizing computing.

Waterproof Smartphones by HZO Technology CES 2013 in Las Vegas





Sun

Distance: 6,695,000 km
Radius: 709,100 km
Apparent diameter: 10° 59' 29.2"
Day length: 25,400 days
Temperature: 23766598 K

2006 06 11 13:24:48 WS
1.000x slower



Speed: 0.00000 m/s

Follow Sun
FOV: 31° 25' 8.8" (1.00x)

Nanotechnology can improve how we

Harness Energy

Distribute Energy

Use Energy



ENERGY

Nanotechnology could transform the ways we create, transmit, store, and use energy. Some scientists think nanotechnology will allow us to build ultra-efficient transmission lines for electricity, produce more effective and inexpensive solar cells, make cheap, efficient biofuels, and improve the safety of nuclear reactors. But more research and investment is needed before nanotechnology energy solutions are developed



Flexible Thin Film Solar Panel

SPIN TO WIN!



Nano is part of our society and our future

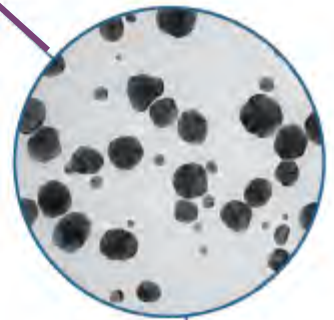
Nanotechnologies have costs, risks, and benefits that affect our lives in ways we cannot always predict.



Nanotechnology will affect our economy, environment, and personal lives.



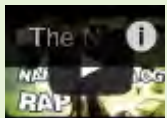
Antibacterial
silver nanoparticles



HIGH EFFICIENCY HIGH CARE



**Adapted from materials
developed for the NISE
Network with funding from the
National Science Foundation
under Award Numbers
0532536 and 0940143**



Mini-Grant Presenters



- The Pink Palace

Pink Palace Mini-Grant 2013



Project Overview

Goal: To provide an educational experience families can share together.

We hosted 2 Nano Science Nights:

- March 19, 2013 – School Science Night
 - We worked with MCS Parent and Community Engagement to bring in students from Memphis City, Shelby County, and DeSoto County Schools.
- April 2, 2013 – Museum Member's Science Night



Target Audience



We had two target audiences in mind for this project:

- Students and their parents who have not been to the museum before (mainly due to financial reasons).
- These individuals likely have little knowledge of Nanotechnology.
- Our Museum members
- We wanted them to experience our exhibits in a new way.

Science Night Activities

During the event, participants did a scavenger hunt and participated in hands-on activities.

•Activities done for the Science Night:

- Instructor Led Touch Cart Activities
 - Exploring Size: Moving Molecules
 - Exploring Properties: Invisibility
 - Exploring Materials: Memory Metal
- On-their-own activities
 - What's nano about a butterfly?
 - What's nano about a pencil?
 - What's nano about chocolate?
 - What's nano about sunblock?
 - What's nano about touch?
 - What's nano about socks?



Results

- We consider both Science Nights as a success:
 - School Science Night served 120 students and 50 adults = 170
 - Member's Science Night served 101 kids and adults total
- Talking with people during the event, we heard:
 - “This was a great event. I learned a lot of new information.”
 - “We want to do this again!”





Questions?

Alex Eilers

Pink Palace Museum

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Mini-Grant Presenters



- James Madison University



Shanandoah Valley Nanoscience Outreach Collaboration

Costel Constantin
James Madison University

Nanodays 2013



National Science Foundation
WHERE DISCOVERIES BEGIN

James Madison University



- Established in **1908** as a the **State Normal and Industrial School for Women at Harrisonburg**.
- Renamed **Madison College** in **1938**.
- In **1966** became a **coed** school.
- In **1977** it was named **James Madison University**.
- Mainly undergraduate public university.
- Located in beautiful Shenandoah Valley, Harrisonburg, VA.
- Total of ~ **20, 000 undergraduate plus graduate students**.



Shanandoah Valley Nanoscience Outreach Collaboration (SVNOC)

Goal of SVNOC

- To help **K-12 teachers** incorporate **nanoscience** concepts into their **classrooms**.

Objectives of SVNOC

1. **Developing** nanoscience **experimental kits** for classroom.
2. **Training** teachers to integrate these kits into their curriculum.

➤ Audience

- **11-15 K-12 teachers from nearby schools (~ 40 miles radius of JMU).**
 - Big majority of them are 4th grade gifted teachers.
 - Children from underrepresented populations and low-income families account in average for 16%, and 43.6% of the total enrolment, respectively.
 - Total of 200 students exposed to Nanoscience through SVNOC.
- **6 JMU professors from Physics, Chemistry and Engineering departments.**

People Making SVNOC Possible

Teachers:

- Bobbie Arbogast (Teacher; John C. Myers Elementary and Lacey Spring Elementary)
- Kevin Carini (Teacher; Luray High School)
- Heather Cherry (Teacher; Mountain View Elementary)
- Linda Doherty (Teacher; River Bend Elementary and Elkton Elementary)
- Linda Harpine (Teacher; Fulks Run Elementary, Linville-Edom Elementary, and Ottobine Elementary)
- Charlotte Holter (Teacher; John Wayland Elementary)
- Brian Lux (Teacher; Cub Run Elementary)
- Krista Miller (Teacher; McGaheysville Elementary, South River Elementary, and Pleasant Valley Elementary)
- Del Taylor (Teacher; Plains Elementary and Peak View Elementary)
- Daniela Sava (Teacher; Shenandoah Valley Governor School)
- Emily Serghie (Teacher; Stuart Draft High School)

JMU professors:

- Prof. Brian Augustine
- Dr. Costel Constantin
- Dr. Kyle Gipson
- Prof. Chris Hughes
- Prof. Robert Kolvoord
- Dr. Scott Paulson

Meeting With the Teachers:

SVNOC Activities

- JMU hosting workshops since 2010.
- The workshops are from 5:30 - 7:00 pm in the Physics Department at JMU.
- Train teachers in using Nanodays experimental kits and some other experiments.
- The workshops are followed by dinner.

Exploring Products-Sunblock

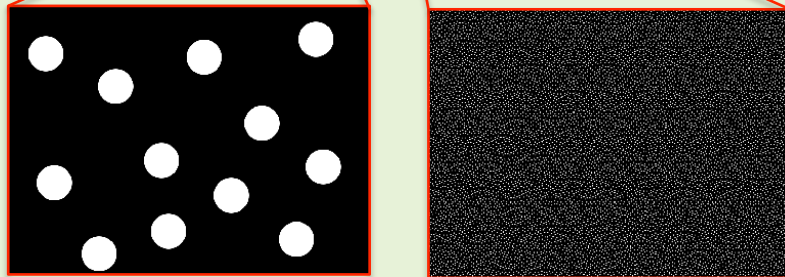
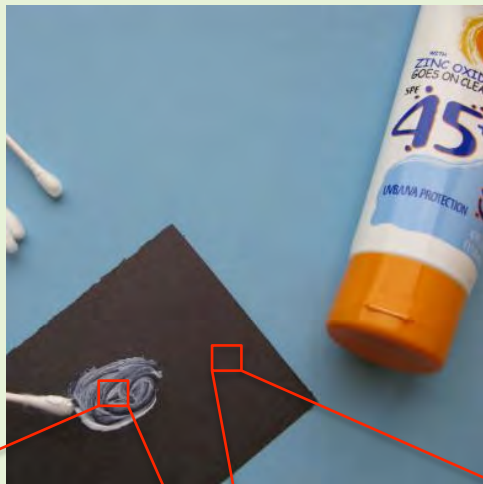


Fig. 1 Example of experiment kit acquired from Nisenet network.



Fig. 2 Teachers workshop (2012).

Introducing New Experiments

What is Graphene?



Fig. 1 (Up) First known pencil made in the Roman empire time¹.
(Down) Pencil art².



Fig. 2 (Up) Ikea pencils.
(Down) British doctors using Ikea pencils.

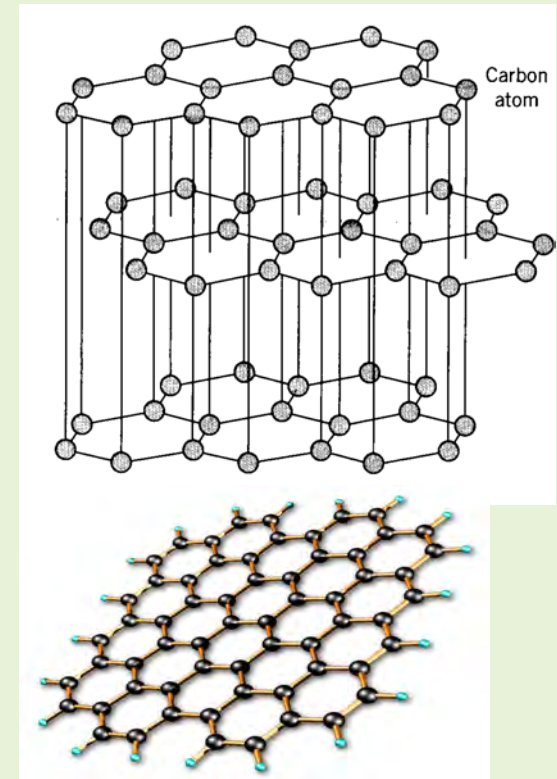


Fig. 3 (Up) Crystal structure of Graphite.
(Down) One sheet of Graphene.

1. <http://www.pencils.com/pencil-history>

2. <http://www.georgehart.com/sculpture/sculpture.html>

3. <http://www.dw-world.de/dw/article/0.,6315805,00.html>

The Physics of Writing

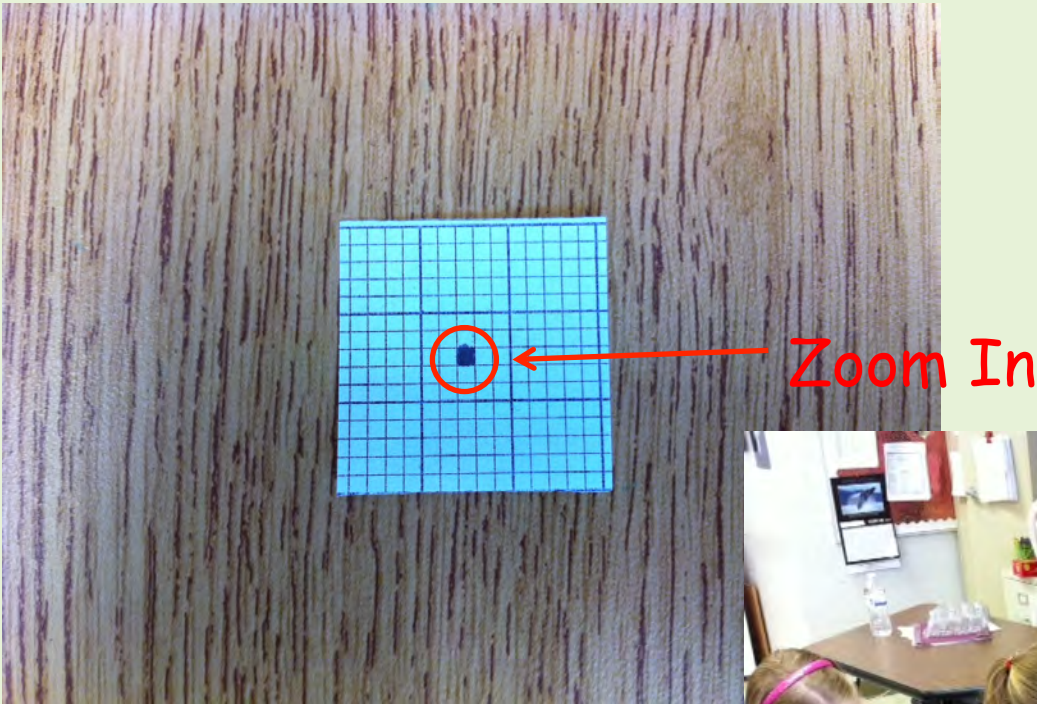
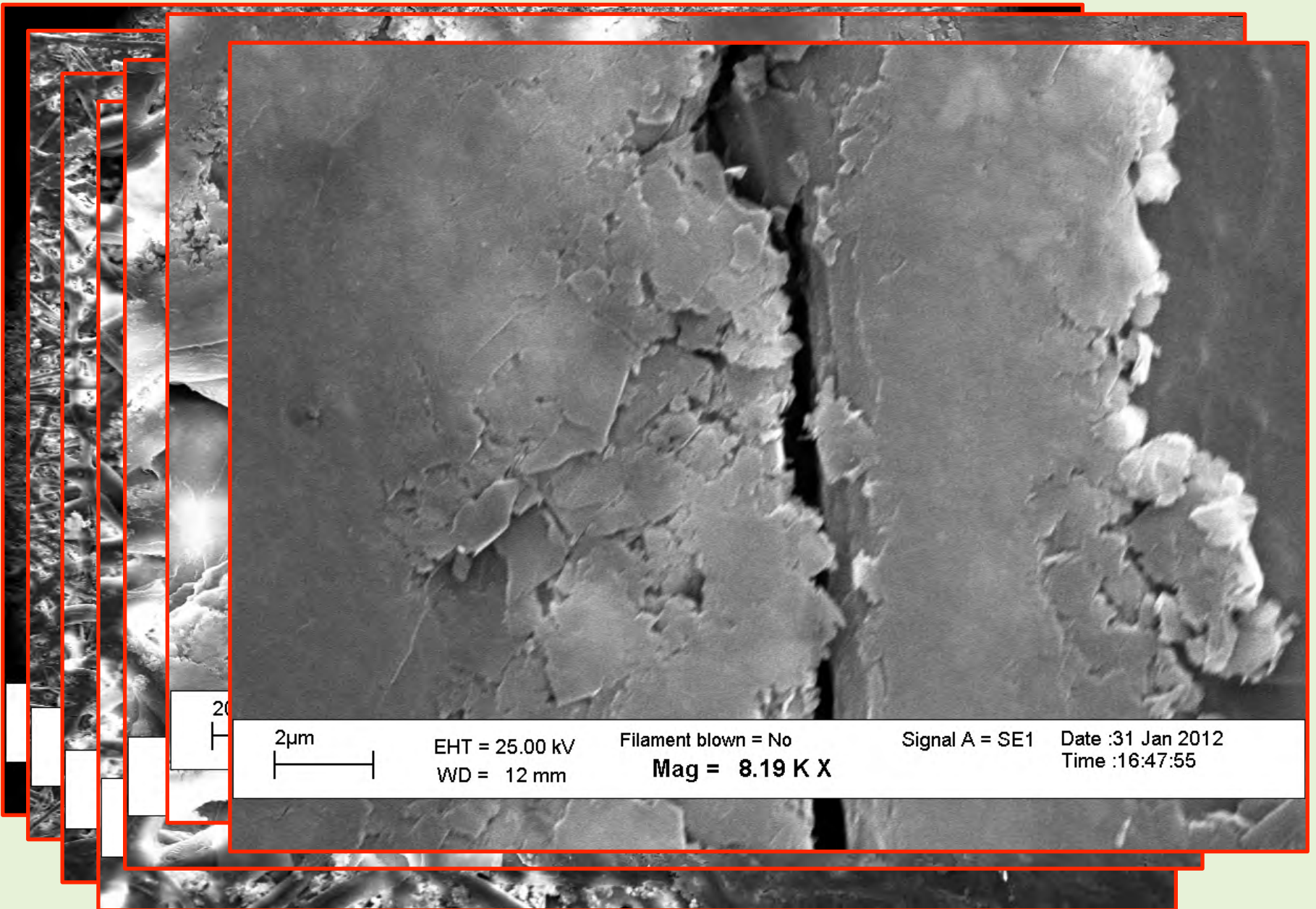


Fig. 1 Millimeter paper experiment



Fig. 2 Forth graders starting the experiment millimeter paper experiment.

The Physics of Writing (cont.)



Follow-up Experiment

- Scotch tape method.

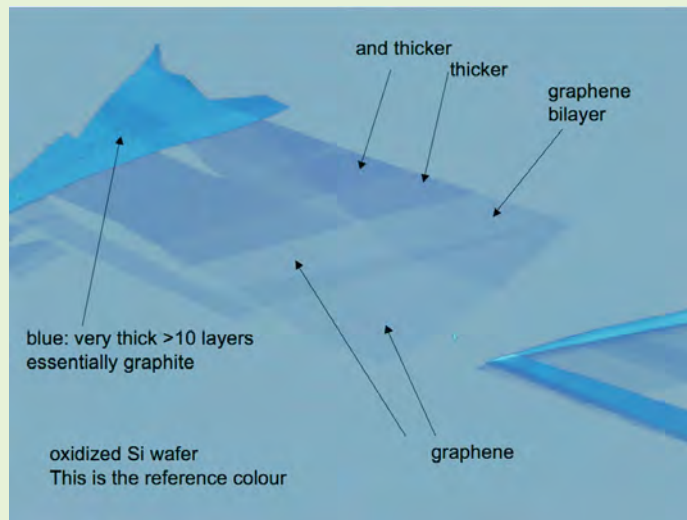
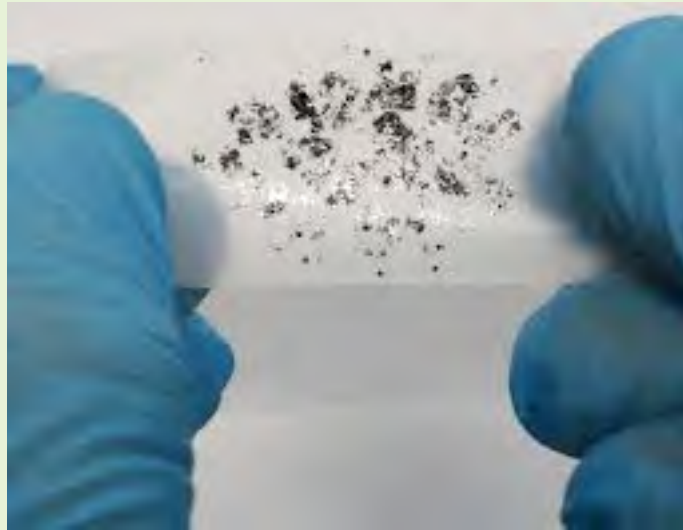


Fig. 1 (Up) Peeling off layers of Graphene.
(Down) Number of Graphene Layers based on color.



Exploring Structures—Butterfly

Try this!

1. Examine the blue and yellow butterflies. Try tilting the case to see the butterflies from different angles. And be sure to look at both the front and back!
2. Shine the light through the butterflies, holding the light underneath the case. Do the butterflies look the same with the light passing through them?

Tip: Squeeze the mini-light to turn it on.

What's going on?

When you turn on the light, the yellow butterfly stays yellow, but the blue butterfly turns brown! That's because the yellow color comes from pigment, but the blue is created by the interference of light bouncing off tiny nanostructures.

The Blue Morpho's wings have very small overlapping scales covered with tiny "ribs." The size and arrangement of these nanostructures makes the wings look blue—but they're actually transparent! There's an air space of a few nanometers between the ribs. Light waves bouncing off the top and bottom surfaces of neighboring ribs interfere with each other. Most light waves are cancelled by the interference and only certain wavelengths—seen as colors—bounce back to your eyes. So when you look at the front of the butterfly, it's a beautiful, iridescent blue.

When the bright light passes through the Blue Morpho's wings, the effect is lost and you see the wings' brown undersides. The back side of the wings is colored by pigment—so the brown side always looks brown.

How is this nano?

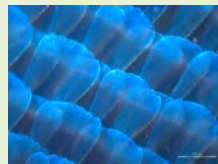
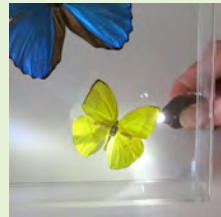
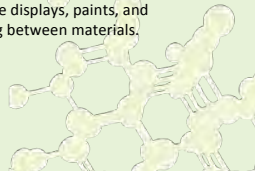
The way a material behaves on the macroscale is affected by its structure on the nanoscale. Nanotechnology takes advantage of different material properties at the nanoscale to make new materials and tiny devices smaller than 100 nanometers in size. (A nanometer is a billionth of a meter.)



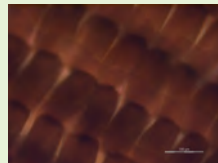
Low-energy display

Nanotechnology allows scientists and engineers to make things like smaller, faster computer chips and new medicines to treat diseases like cancer.

Some nanotechnology and nanomaterials are inspired by nature. Scientists are working on new nanotechnologies that mimic the Blue Morpho's wings. They've already invented low-energy smartphone displays, paints, and fabrics that change color by changing the spacing between materials.



Light reflecting off the wings



Light passing through the wings

Pre-activity/Post-activity questions:

1. How is a Blue Morpho Butterfly related to Nanotechnology?

Answers:

- It has nanoparticles in it/ Stuff that has nano in it can change color by the light.
- Because you can see right threw the wings with a microscope /By the way the reflection shines on the brown side of the butterfly on the micro scale.
- You can see what the wings look like/ The nanoparticles reflect light and make it change colors.
- It's a part of nature/ Light bounces off of the nanostructure and it appears different to our eyes.

2. How are scientists mimicing the blue morpho wings?

Answers:

- Because they are trying to make the butterfly/ They are trying to figure out how the morpho changes colors.
- By making plastic butterflies/ By making low energy cell phones, fabric that changes colors, and paints that change color by reflection.

Things We Have Learned ...

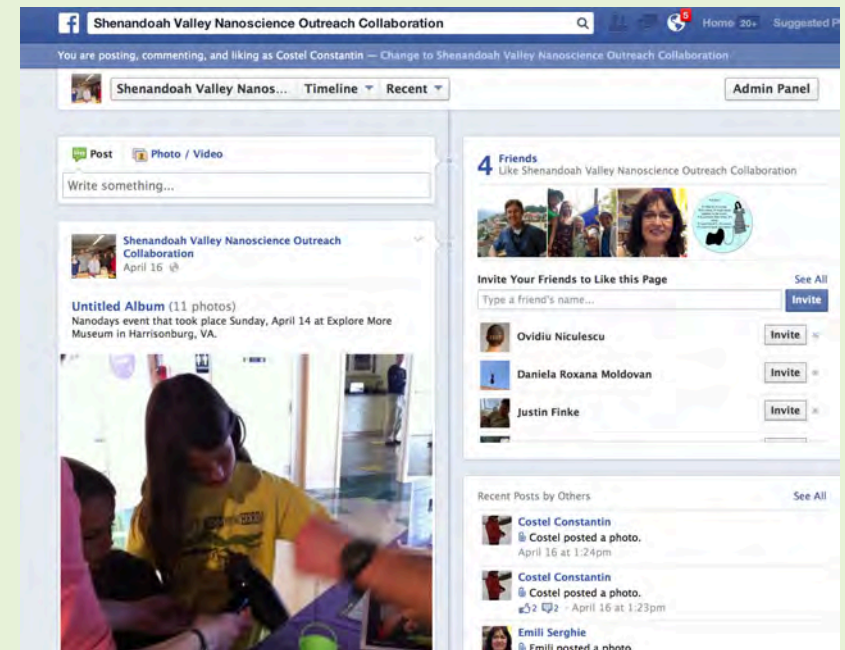
- “To be, or not to be: that is the question:”
 “How Small is Small: That is the Question”.
- When visiting 4th graders increase your tolerance for sarcasm!
- Continue helping teachers understand nanoscience.
- Create smarter ways of assessment.
- **“Do Not Give Up ... Keep Inspiring Young Minds”.**

Acknowledgements

- Dr. Harry Hu for instrumental support and Mr. Arthur Fovargue for stockroom/purchasing support.
- All the K-12 and JMU professors participating in this effort.
- These workshops are co-sponsored by the JMU Center for Materials Science and the JMU Center for STEM Education Outreach.
- Nisenet Mini-Grant titled “Shenandoah Valley Nanoscience Outreach Collaboration”.

“Shenandoah Valley Nanoscience Outreach Collaboration” Costel Constantin, Christopher Wm. Hughes, Brian H. Augustine, Scott Paulson, MRS Online Proceedings Library , Vol. 1583 (2013)
DOI: <http://dx.doi.org/10.1557/opl.2013.777>

Media Advertising ...





Introducing New Experiments

What is Graphene?

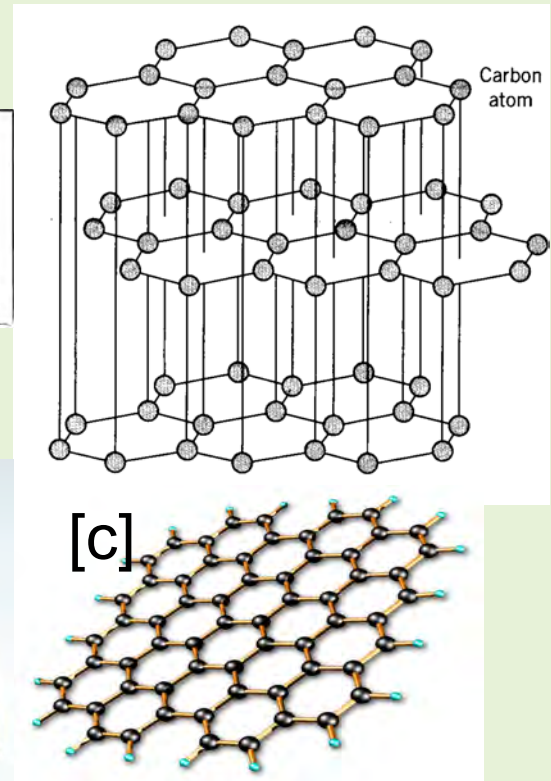


Fig. 1 (Up) First known pencil made in the Roman empire time¹.
(Down) Pencil art².

Fig. 2 (Up) Ikea pencils.
(Down) British doctors using Ikea pencils.

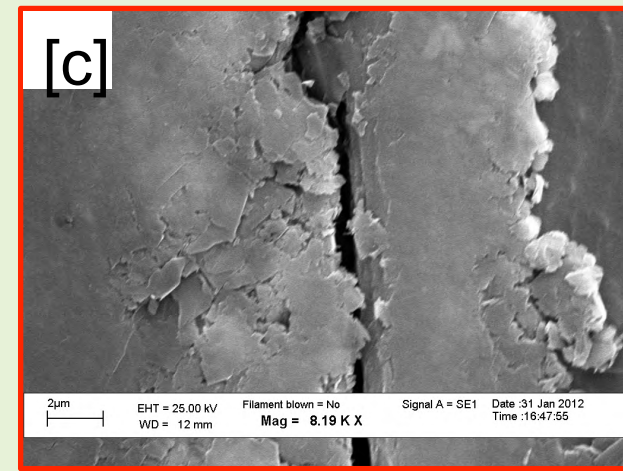
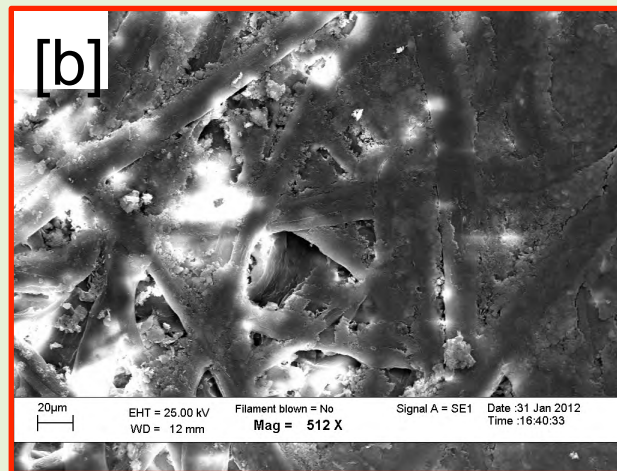
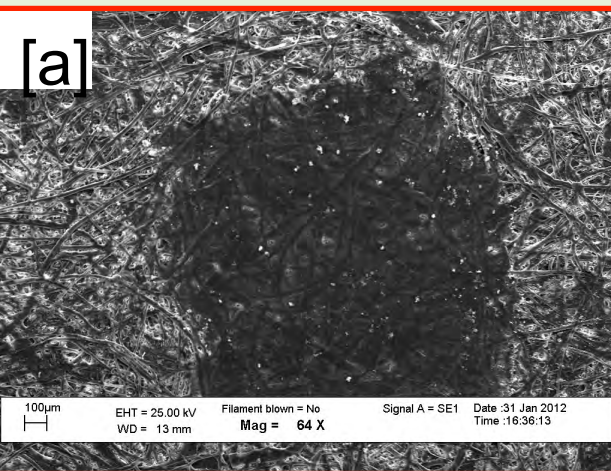
Fig. 3 (Up) Crystal structure of Graphite.
(Down) One sheet of Graphene.

1. <http://www.pencils.com/pencil-history>

2. <http://www.georgehart.com/sculpture/sculpture.html>

3. <http://www.dw-world.de/dw/article/0,,6315805,00.html>

The Physics of Writing (cont.)



Making the most of your NanoDays Kit

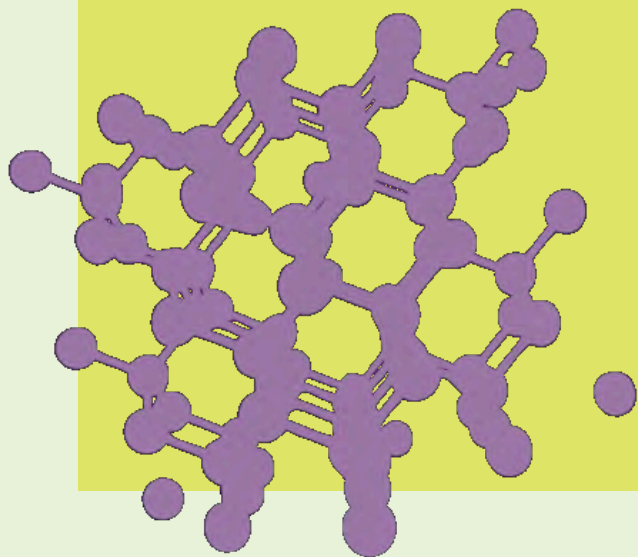
- GA Tech, Fernbank Science Center
- Adventure Science Center
- SciWorks

Making the most of your NanoDays Kit

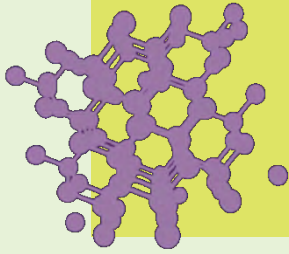
- GA Tech, Fernbank Science Center



NNIN and Fernbank Science Center



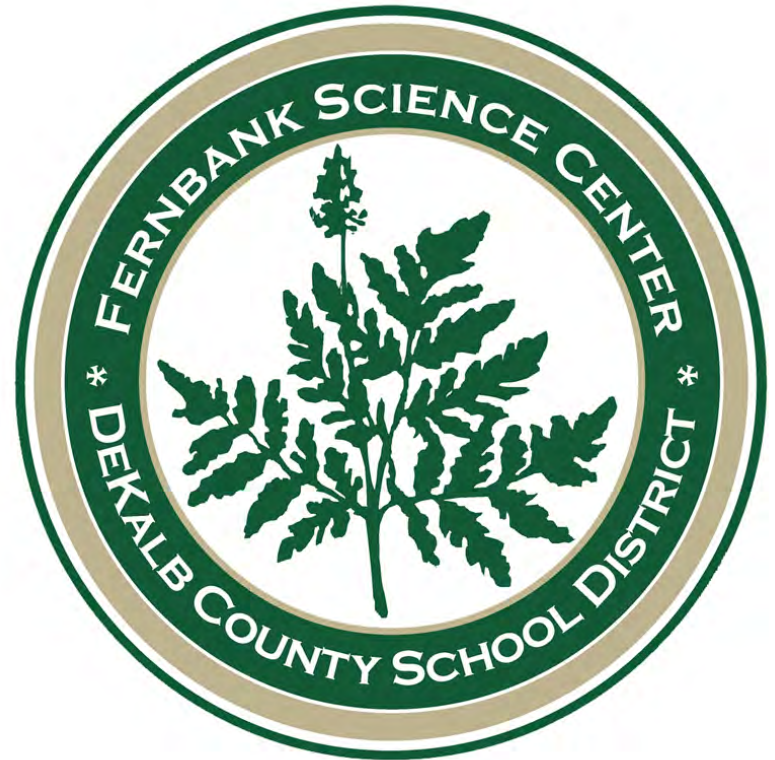
Nancy Healy
Mary Breen
Vashonda Davis

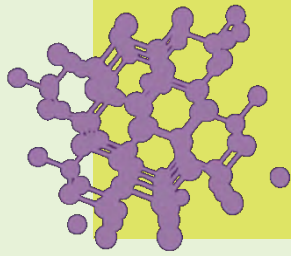


Who We Are

NNIN

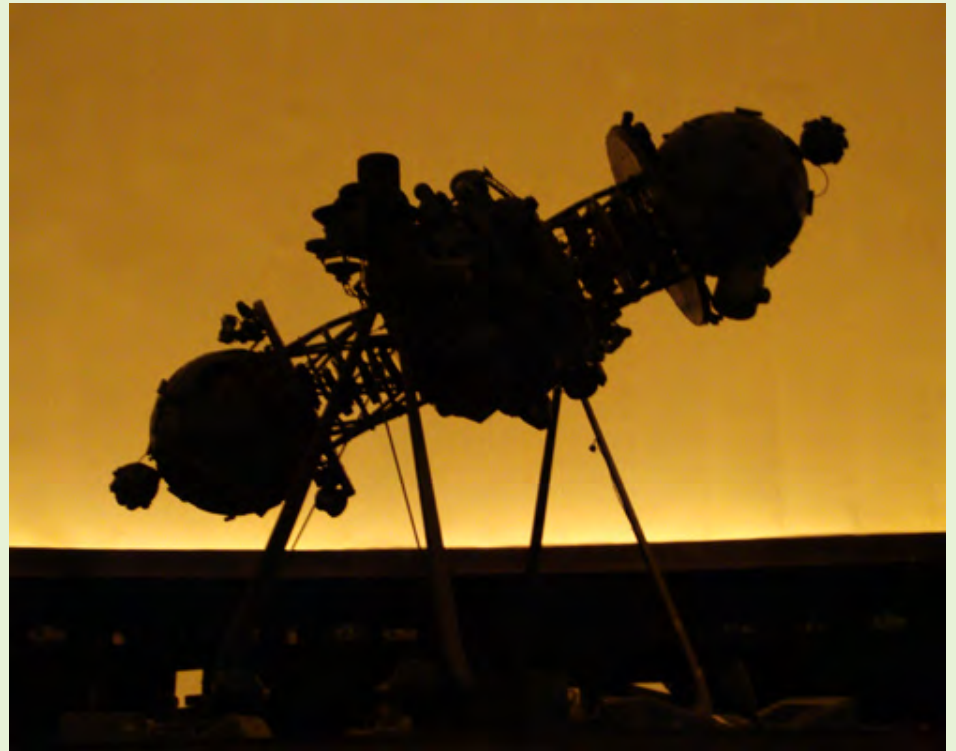
Nanoscale Science,
Engineering & Technology



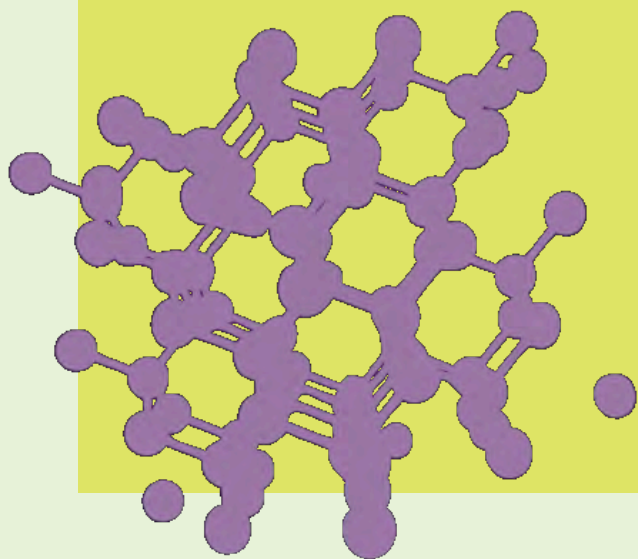


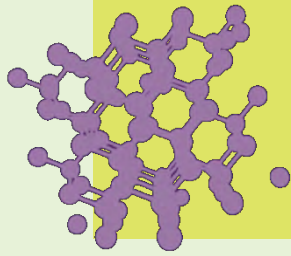
Fernbank Science Center

- DeKalb School District
- 20 instructors
- 500 Seat Planetarium
- Observatory
- Public Exhibit Hall
- Science Resource Library
- Compost Garden
- **Programming:**
 - Teacher Professional Development
 - STT
 - Advanced Studies
 - Vocational Horticulture for special needs students
 - Outreach
 - Public Programs



Our Relationship

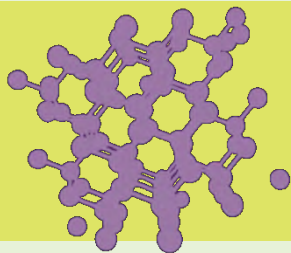




NanoDays 2010

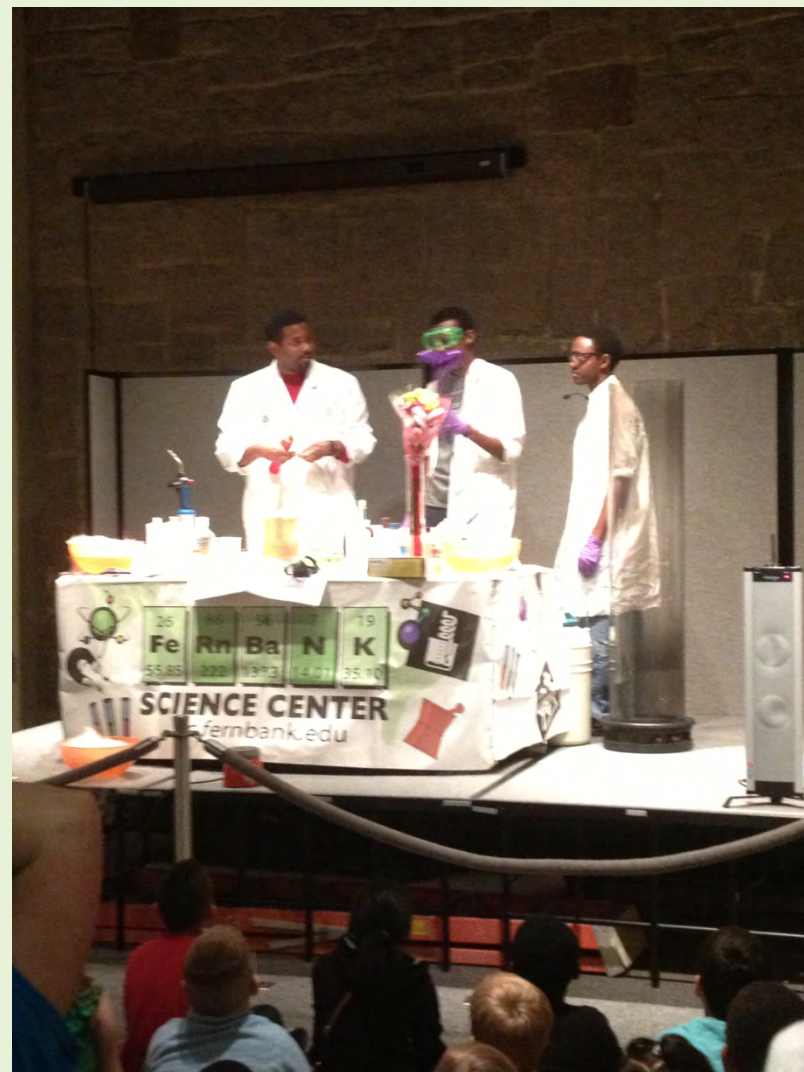
- Kits from NNIN
- Saturday event
- 8 activity tables
- 10-15 student volunteers
- ~150 visitors

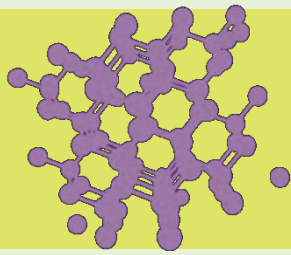




NanoDays 2011

- Kits from FSC & NNIN
- Saturday event
- 10 activity tables
- 20 student volunteers
- ~200 visitors

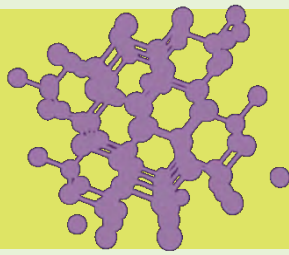




NanoDays 2012

- Kits from NNIN
- Saturday event
- 10 activity tables
- 40 student volunteers
- ~300 visitors





NanoDays 2013

- Kits from FSC & NNIN
- Saturday event
- 10 activity tables
- 40 student volunteers
- ~400 visitors



NanoDays™

The Biggest Event for the Smallest Science!

at Fernbank Science Center
Saturday, March 30, 2013
Noon - 3:00 pm

Fun and Learning for ALL AGES

Hands-on Activities

Nano Magic Show

**FREE
ADMISSION**

Storytime:
**HORTON
HEARS
A
WHO!**

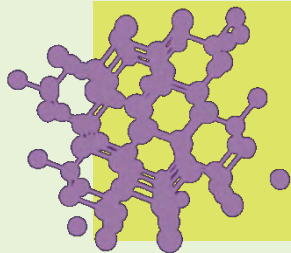


Nanozone:
Special activities for
our pint-sized scientists (ages 3 - 7)

678-874-7102
For more information



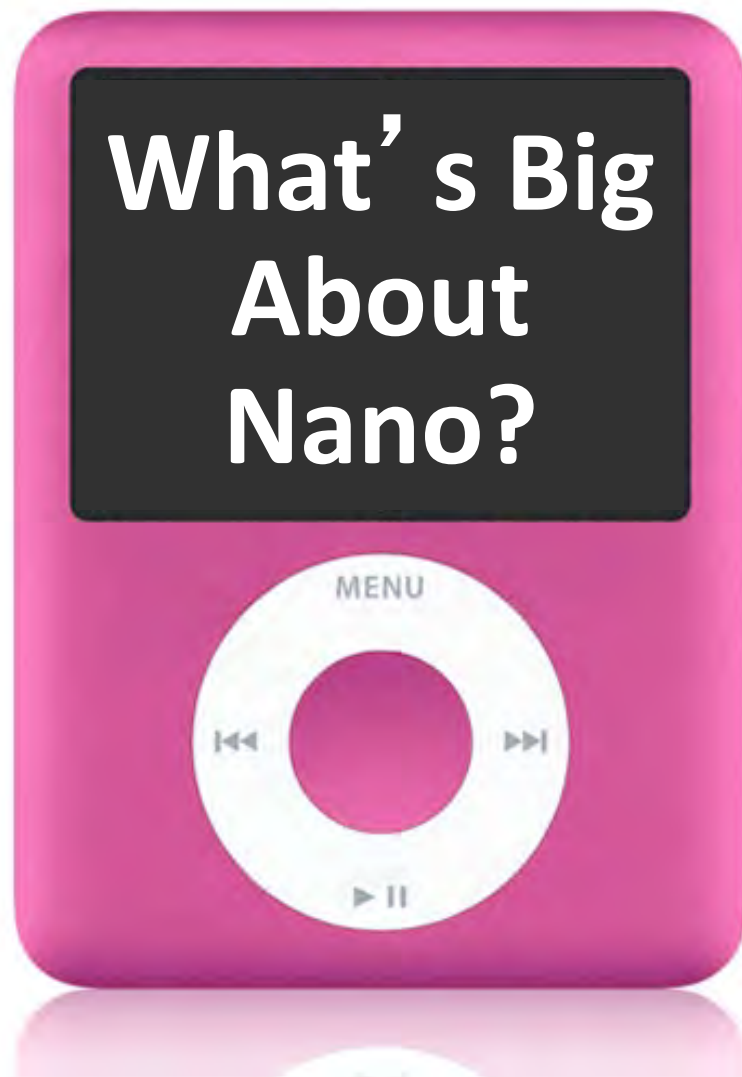
Fernbank Science Center 156 Heaton Park Drive, NW, Atlanta, GA 30307

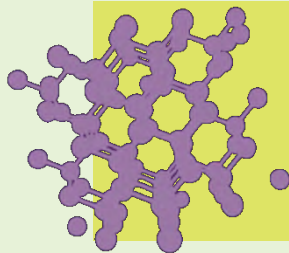


After NanoDays

- 8th grade outreach
- 18 Middle Schools

**What's Big
About
Nano?**





After NanoDays

Chemistry Day at Fernbank Science Center

National Chemistry Week 2012

Nanotechnology:
The Smallest BIG Idea in Science

Saturday, October 27, 2012
12:00 pm - 4:00 pm

FREE ADMISSION

National
Chemistry
Week

Fun and Learning ALL Afternoon

Hands-on Activities
Chem Magic Shows

Use a Scanning Electron Microscope
See Nano in Nature with LIVE Geckos
Even Pumpkin Chemistry!



ACS
Chemistry for Life®



NNIN

Nanoscale Science,
Engineering & Technology

Fernbank Science Center 156 Heaton Park Drive Atlanta, GA 30307

Bite Size Science Day

**BITE SIZE SCIENCE
FOR PINT SIZE SCIENTISTS!**

Saturday January 26, 2013
12:00 pm - 4:00 pm

Special activities for
Children ages 3 - 7 years old

Hands-on Activities

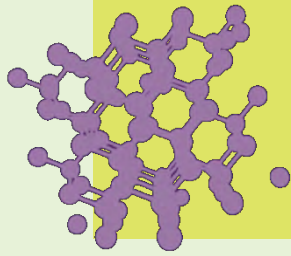
- Race Cars Down Ramps
- Sort Rocks & Minerals
- Make Ooey Glooey Things
 - See Color Magic
- Use Real Science Tools
- And more!



FREE ADMISSION



Fernbank Science Center 156 Heaton Park Drive Atlanta, GA 30307



Future Endeavors

- Teacher Professional Development
- NanoDays 2014 and Atlanta Science Festival



the end

8GB

Model No. MD802JLL/A
Designed by Apple in California. Assembled in China.
Warranty: 1 Year. FCC No. 1581. Serial No. 1771 (A) 1771



Making the most of your NanoDays Kit

- Adventure Science Center

SCIENCE
+ FUN =



NanoDays: **The Biggest Event for the Smallest** **Science!**

Saturday, April 27, 2013
11 a.m. to 3 p.m.



Do you think the cloak of invisibility is possible? How are 3D images made? What are hydrogels and liquid crystals?



Part of a nationwide festival of educational programs about nanoscale science and engineering



**NanoDays at Adventure Science Center
features the miniscule world of atoms,
molecules, and nanoscale forces**



**Explore how 3D images are made, investigate
new nano products and materials, and
imagine
what the world might look like if we could
build an elevator to space!**



NanoDays for School groups Too!

**Each Wednesday, April 17 to May 29
Free on-the-floor programming from 11 to 3**



**Students from Vanderbilt – our
Scientists on the Spot – will be
on the floor presenting
nanoscale science**



Think about how liquid crystal displays and computer hard drives work or three-dimensional imaging – how is it done and why.

Be sure to stop at the Discovery Carts to learn more!



**Binary
hydrogel
3D imaging
liquid crystals
gummy capsules
moving molecules
nanogold and ferrofluid & iron tubes**



Be sure to stop at their Discovery
Cart to learn more!

Binary
hydrogel
3D imaging
liquid crystals
gummy capsules
moving molecules
nanogold and ferrofluid & iron tubes

SCIENCE
+ FUN =



NanoDays: The Biggest Event for the Smallest



Making the most of your NanoDays Kit

- SciWorks

NISE network

NanoDays

Nano Science & Tech Day

Science Café

Cart demonstrations

Nano Mini-Grant:

- Butterfly exhibit

- Volunteer training

- Nano Cart

Nano mini-exhibit



Volunteer Training Workshop





Nano Demonstration Cart



NanoDays





Nano Science and Technology Day









Resources



Nano cart (mobile work station): Uline

www.Uline.com

Graphic: Nvizion Inc.

www.nvizioninc.com

Graphic Design: Firebird Design Studio

www.firebirddesignstudio.com

Butterflies: Butterfly Utopia

www.butterflyutopia.com



Inclusive Audiences - Bilingual Audience Workshop



- Marbles Kids Museum

NISE Net Bilingual Audiences Workshop

Alex Laube

STEM Program Play Lead

alaube@marbleskidsmuseum.org



www.marbleskidsmuseum.org

NISE Net Bilingual Audiences Workshop Overview

- June 5,6,7 2013
- Hosted by Children's Museum of Houston
- Partners current strategies for engaging bilingual audiences
- Marketing Bilingual Programs
- Utilizing staff and volunteers
- Mini-Grants
- And....



Strategies For Engaging Bilingual Audiences

- Zip, Zap, Zop
- Sheltered Instruction



THANK YOU!

To all our partners - we could not do this work without you!

