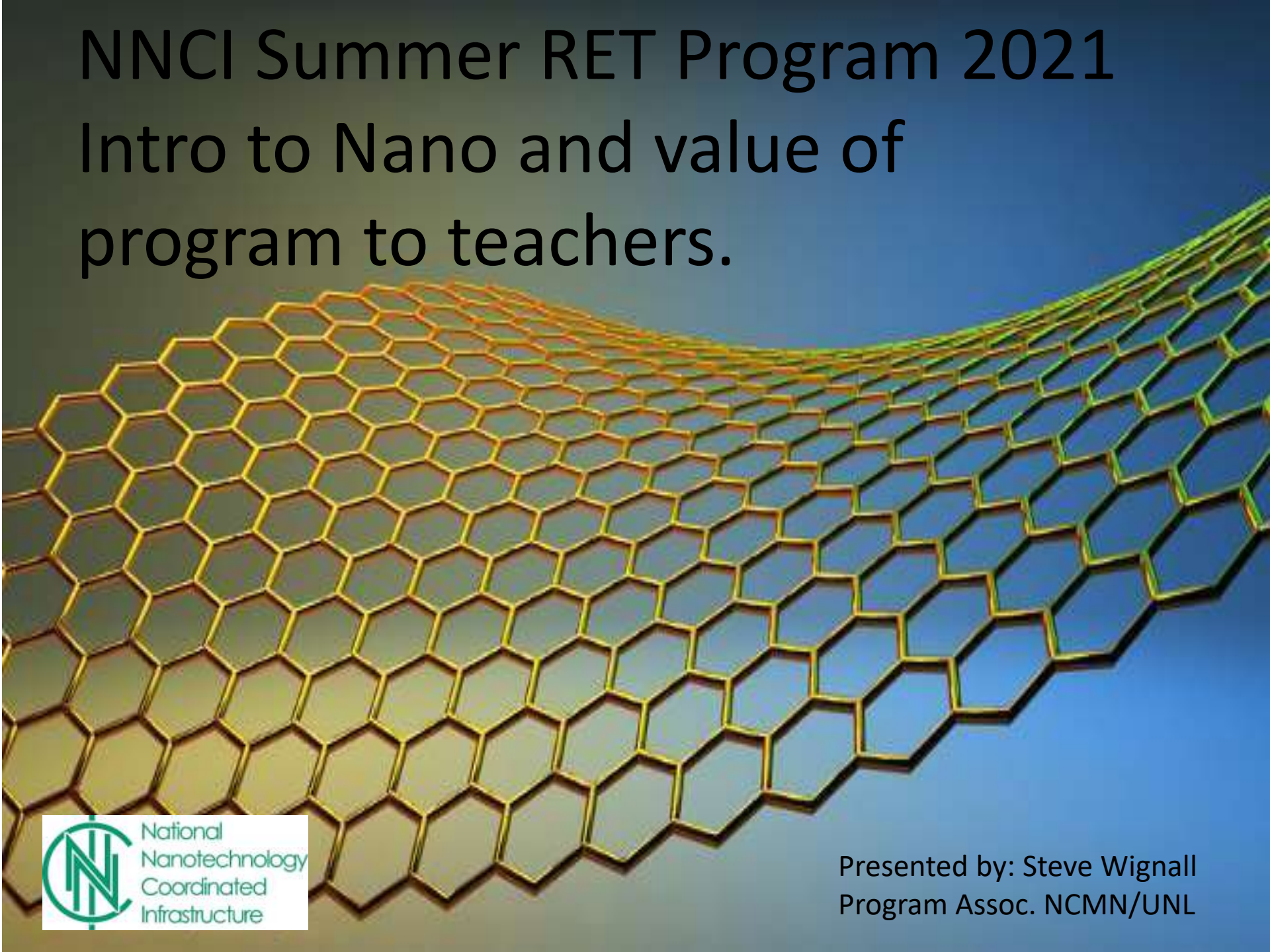
NNCI Summer RET Program 2021 Intro to Nano and value of program to teachers.



National Nanotechnology Coordinated Infrastructure

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Program Assoc. NCMN/UNL

Objectives for Today:

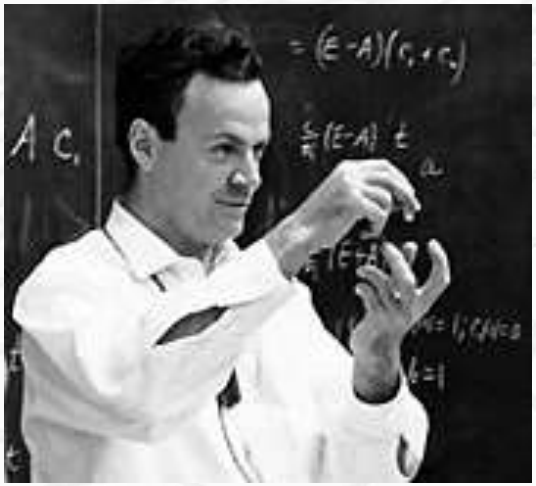
- What is Nanotechnology?
- How can I integrate it in to my Teaching?
- How could I grow as a Teacher through this experience?

What is Nano?:

- **Nanotechnology** is the study of manipulating matter on an atomic scale.
- **Nanotechnology** refers to the constructing and engineering of the functional systems at very micro level or we can say at atomic level.
- A **Nanometer** is “one billionth” of a meter, roughly the width of three or four atoms. The average human hair is about 25,000 nanometers wide.

What Is Nanotechnology?

Nanotechnology is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers.



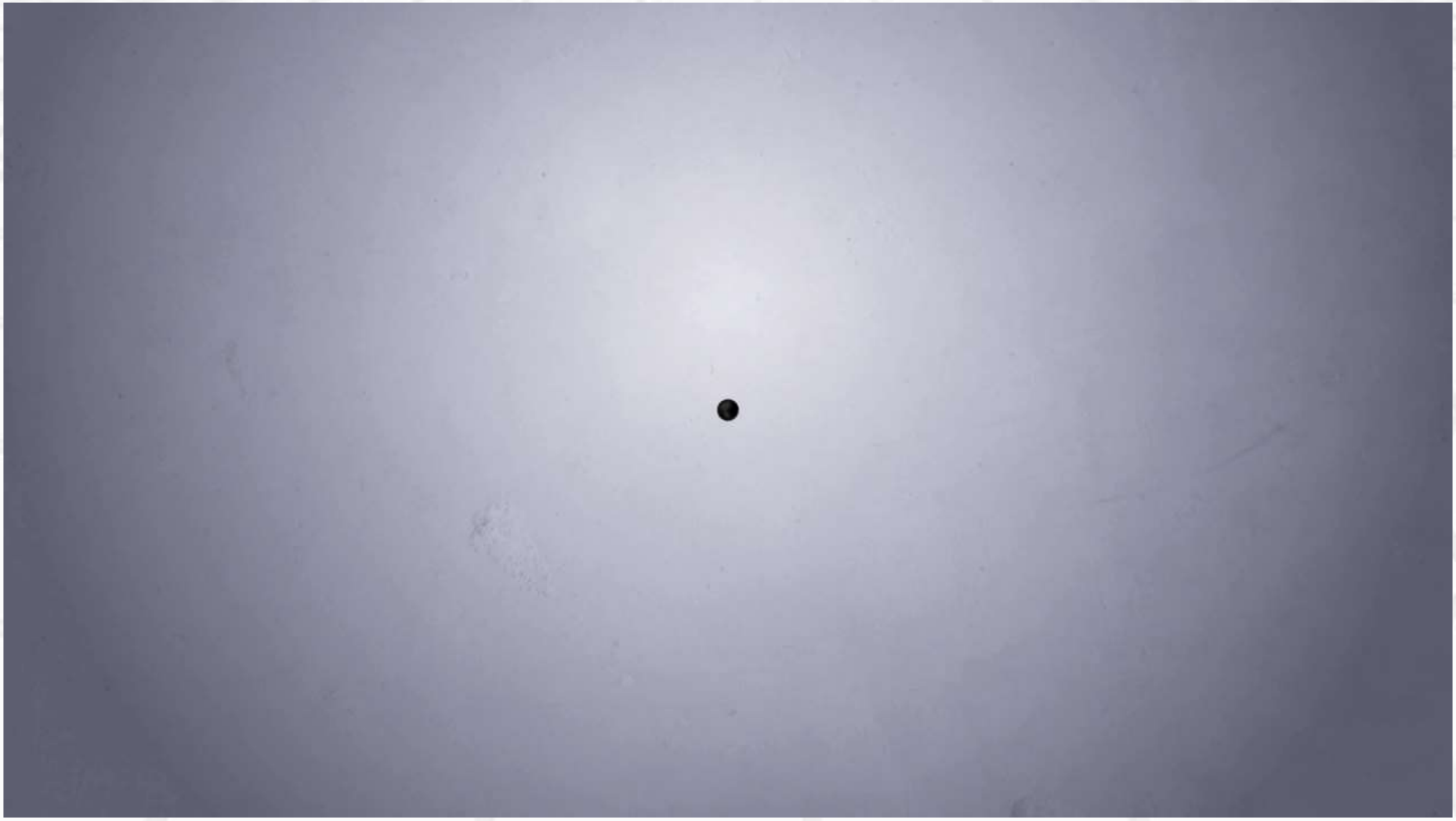
Physicist Richard Feynman, the father of nanotechnology.

Nanoscience and nanotechnology are the study and application of extremely small things and can be used across all the other science fields, such as chemistry, biology, physics, materials science, and engineering.

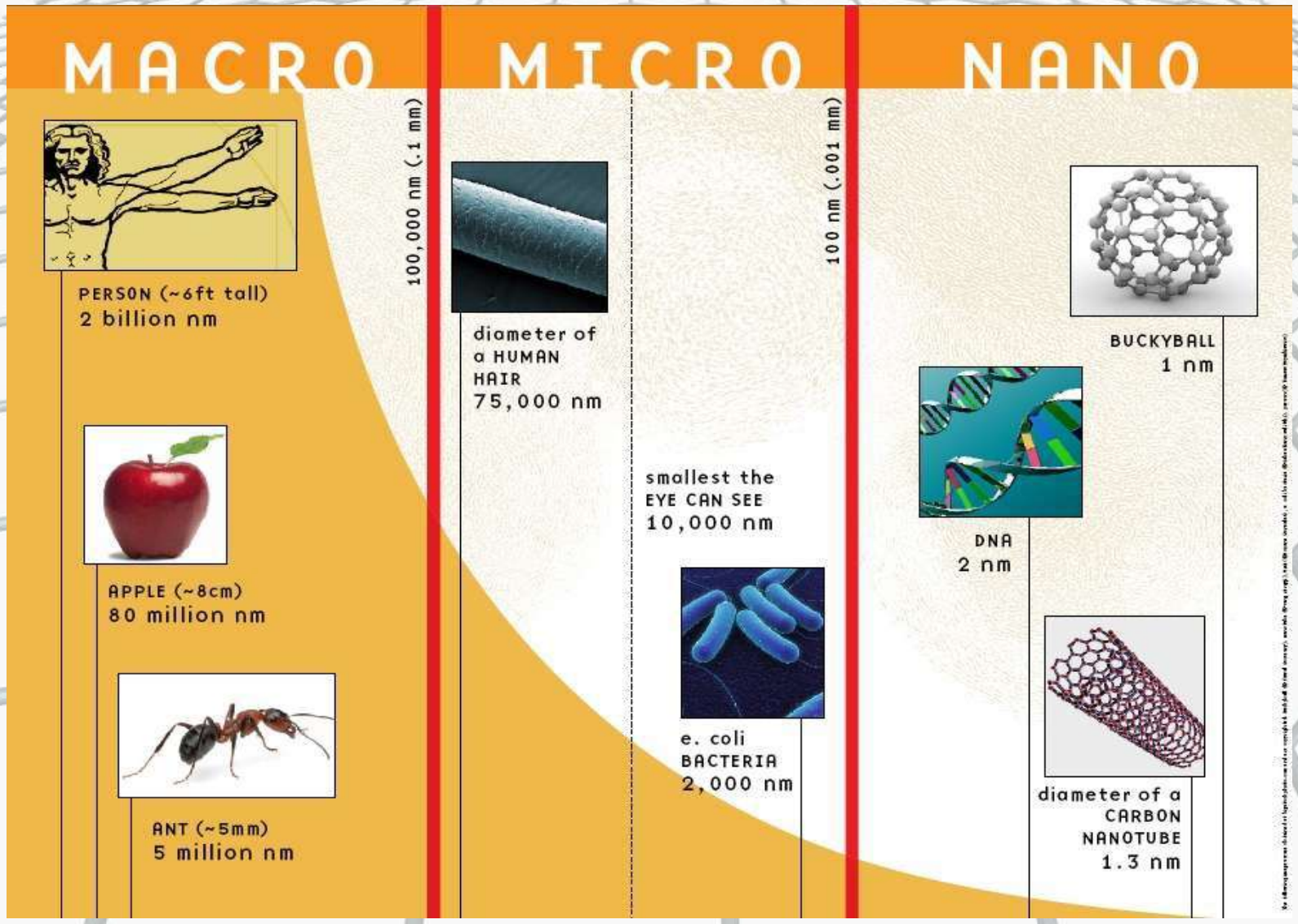
How It Started

The ideas and concepts behind nanoscience and nanotechnology started with a talk entitled “There’s Plenty of Room at the Bottom” by physicist Richard Feynman at an American Physical Society meeting at the California Institute of Technology (CalTech) on December 29, 1959, long before the term nanotechnology was used. In his talk, Feynman described a process in which scientists would be able to manipulate and control individual atoms and molecules. Over a decade later, in his explorations of ultraprecision machining, Professor Norio Taniguchi coined the term nanotechnology. It wasn't until 1981, with the development of the scanning tunneling microscope that could "see" individual atoms, that modern nanotechnology began.

What is Nano?:



Size Comparisons:



Applications:

NEXT GENERATION SCIENCE STANDARDS
For States, By States

Curriculum Integration:

HS-PS2-6. Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.
HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.
MS-ETS1-4. Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Curriculum:

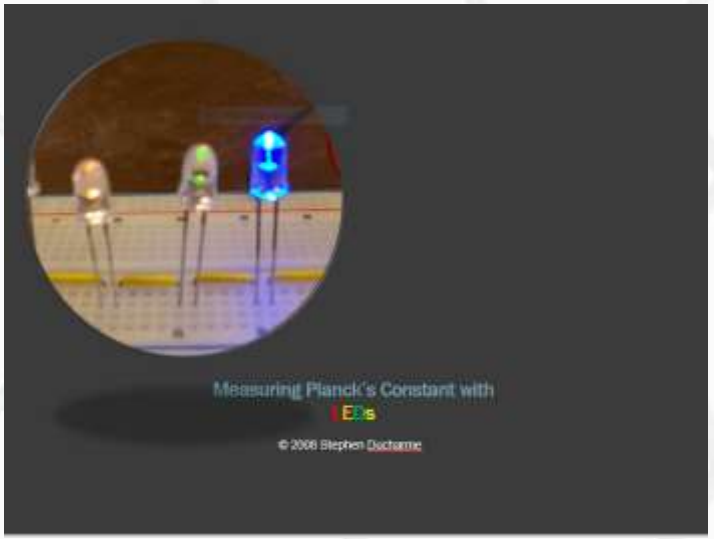
Sites:

- NNCI Resources for Educators (K-16)

  -https://www.nnci.net/resources-educators-k-16

- Develop your own Lessons

  -https://ncmn.unl.edu/teacher-resources#tab4



Growth:

"This summer I continued to do research with Professor Ducharmes' group. My experiences began another new pathway with the fabrication of different Diisopropylammonium (DIPA) salts. My role was to grow these salt crystals and try to find a reproducible way of doing this consistently. This has become a new emphasis of the group, and it was very interesting and beneficial for me to be involved in this aspect of the research. Besides this, I continue to assistance in the educational outreach of NCMN and MRSEC to Nebraska science teachers and students. This summer the outreach grew considerably with my involvement in 8 activities. There were 3 teacher workshops in cooperation with NCMN and also 3 Nanotechnology camps through Bright Lights and Upward Bound for middle and high school students.

Experiences:

Three high-school teachers/MRSEC researchers attended the November 2004 MRS meeting. Michelle Strand, Pamela Rasmussen, and Steven Wignall (left to right) attended the conference and presented three papers. Michelle and Steven's paper (co-authored by MRSEC researcher Diandra Leslie-Pelecky) won the Trophy Award for the best paper in the Symposium on *Coupling Materials Science Education with Research and Technology*.

Their paper, entitled "Research experiences for teachers in materials science: A case study" gave much practical advice and many guidelines about how researchers and teachers can effectively work together. This paper will be published in the Journal of Materials Education.

MRSEC summer teachers Nick Reding (left) and Steve Wignall (middle) check out a Tesla Motors Roadster at the LES wind turbine site. The $135,000 Tesla roadster, the world's first all-electric production car, made a pit stop in Lincoln to promote green technology and charities. (July 2009)

Thank You

Any Questions?