

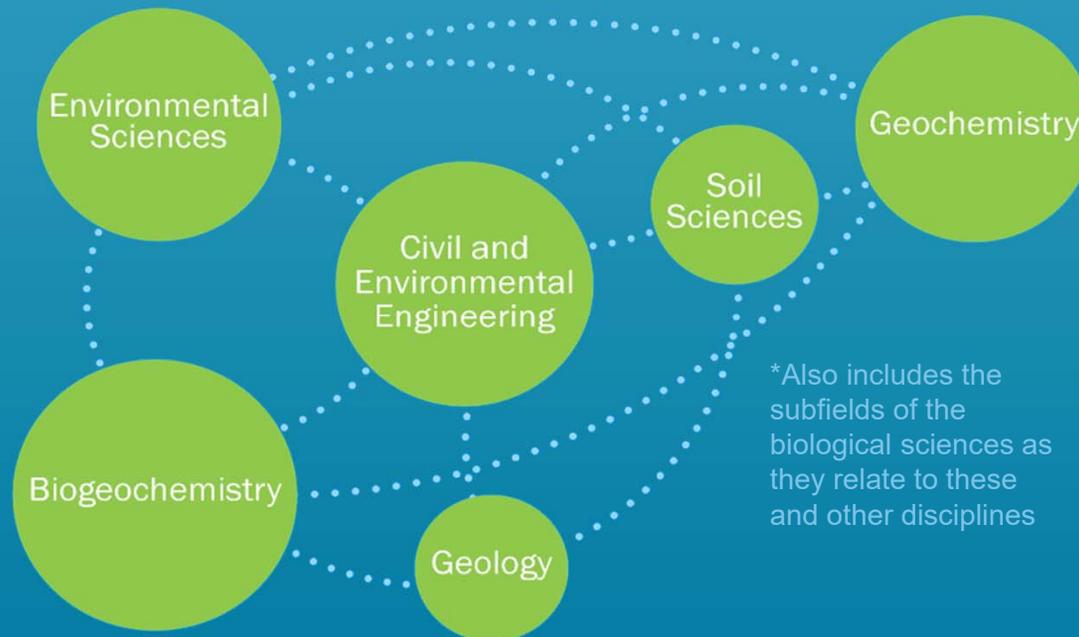


National Center for
Earth & Environmental
Nanotechnology Infrastructure

Our Mission

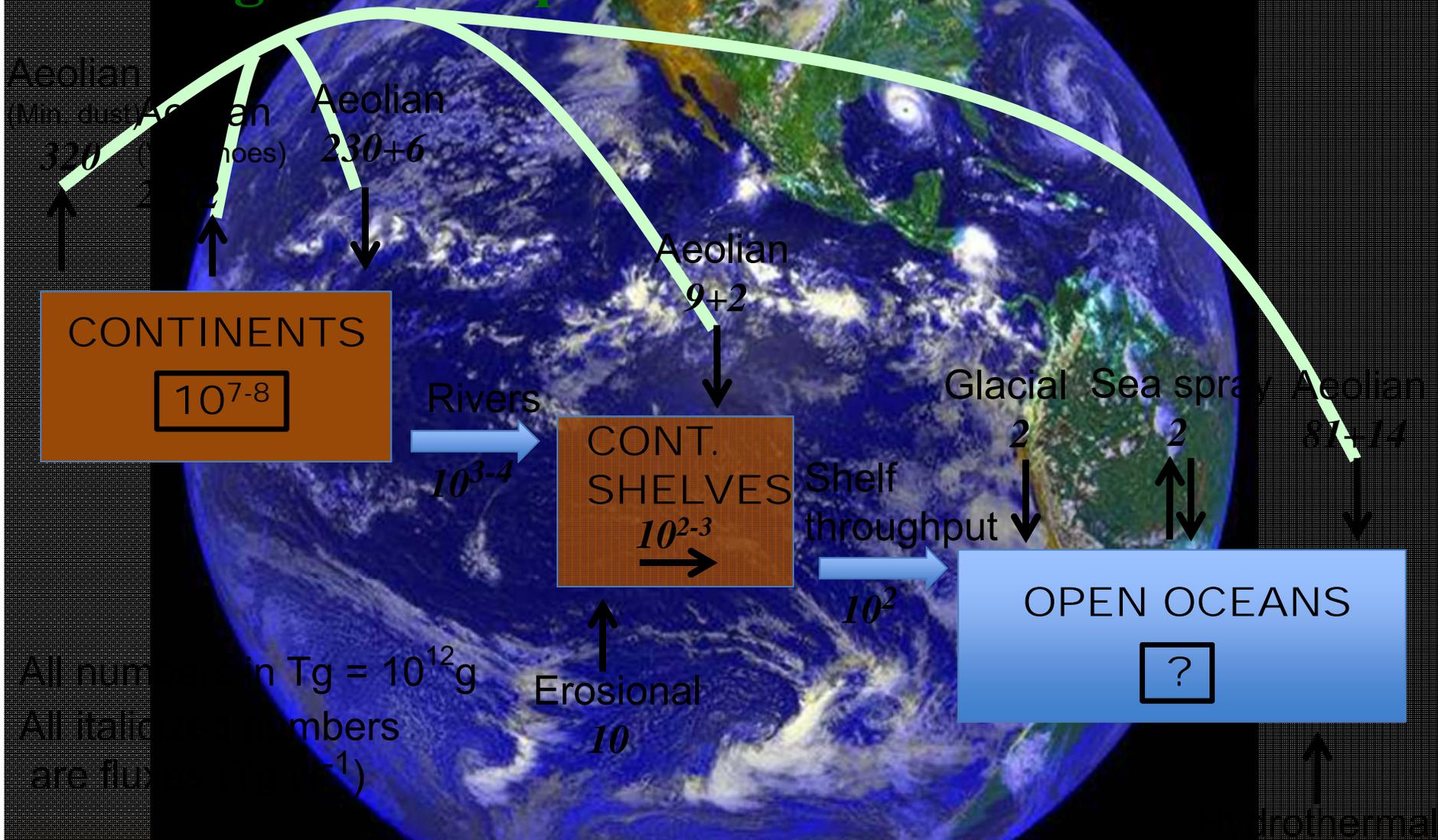
To support researchers who work with nanoscience and nanotechnology aspects of the Earth and environmental sciences and engineering at local, regional, and global scales.

Areas of Study

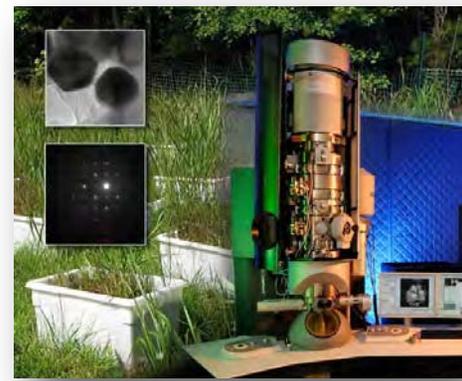


*Also includes the subfields of the biological sciences as they relate to these and other disciplines

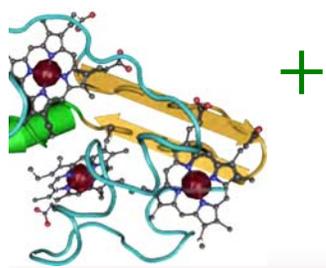
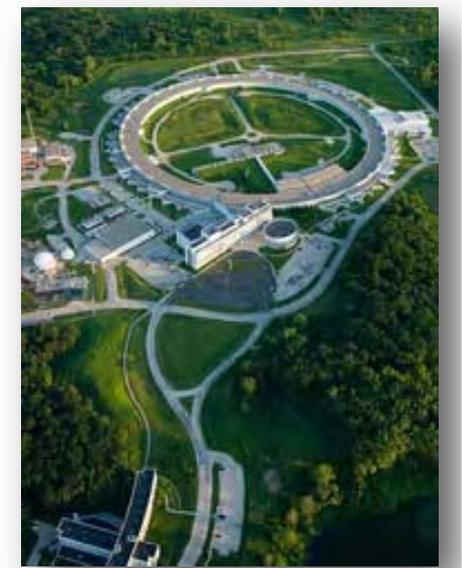
The global budget for naturally occurring inorganic nanoparticles



All numbers in $Tg = 10^{12}g$
 All italicized numbers
 are fluxes ($Tg yr^{-1}$)

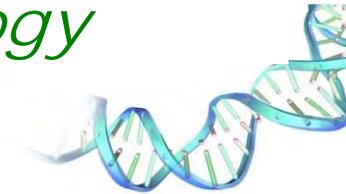


nanoscience and nanotechnology



+

Molecular Biology



+

Earth & Envir



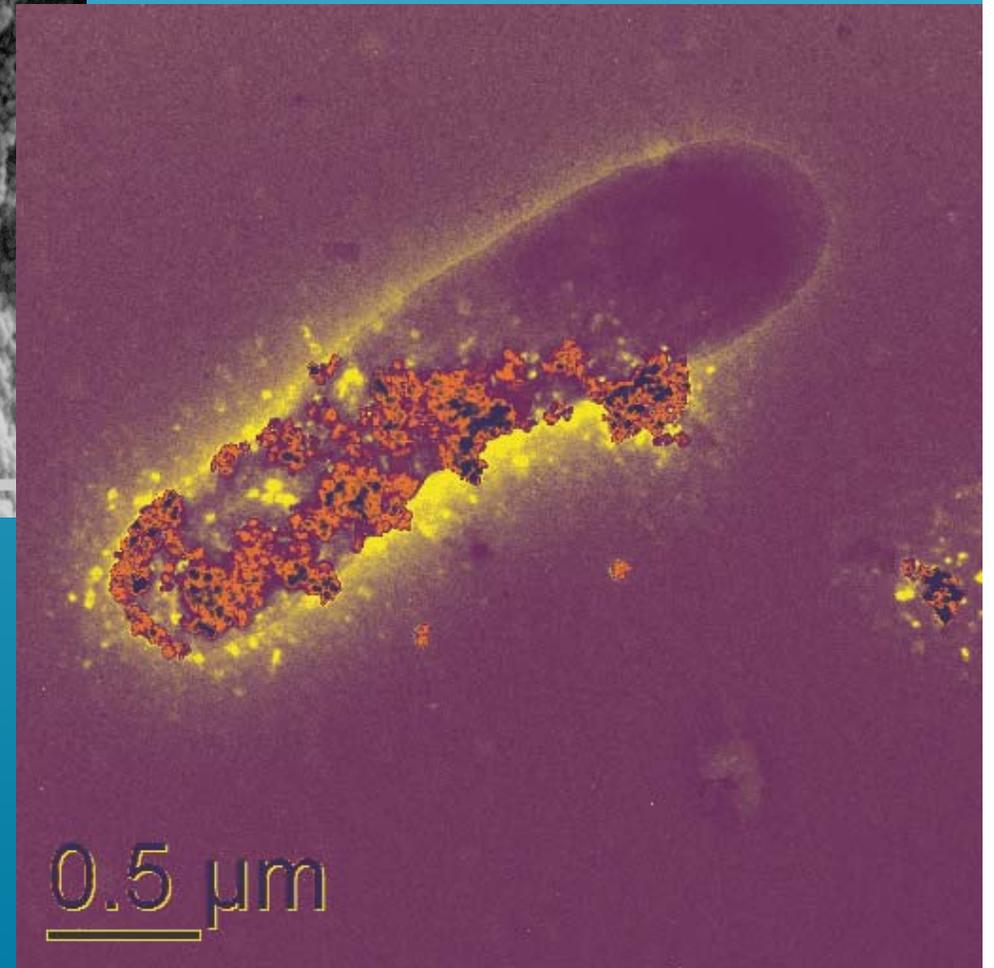
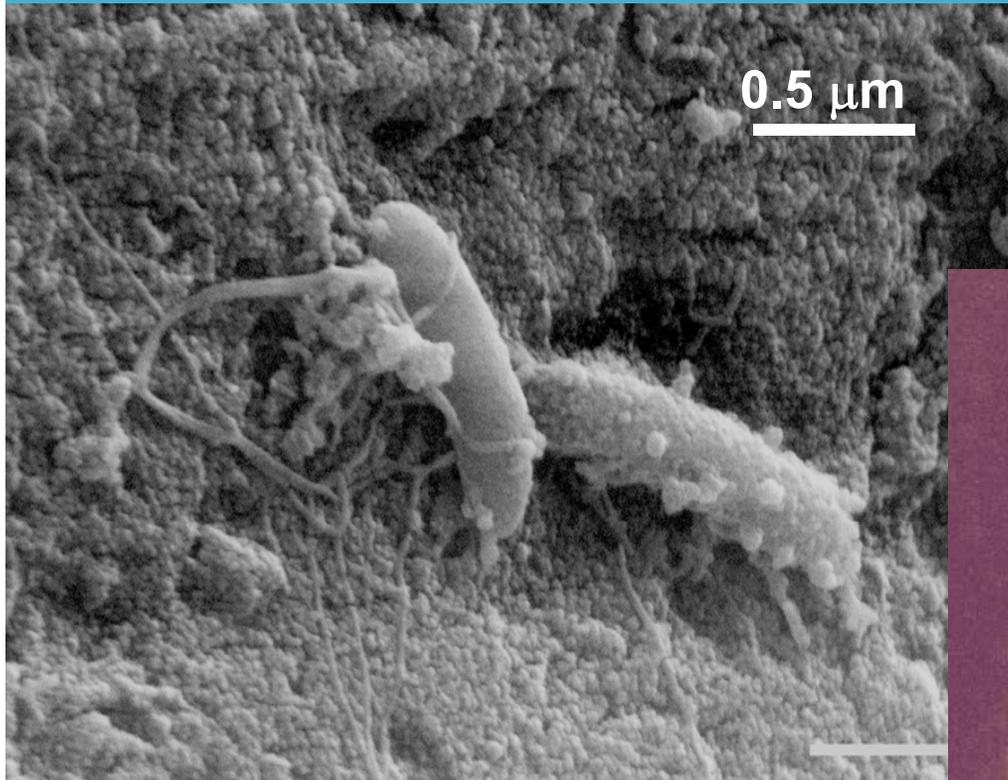
Quantum Confinement in Hematite

a_B written in terms of a_0 :

$$a_B = \frac{\epsilon m_0}{\mu} a_0$$

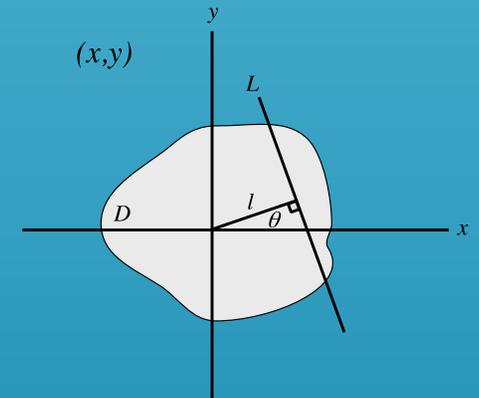
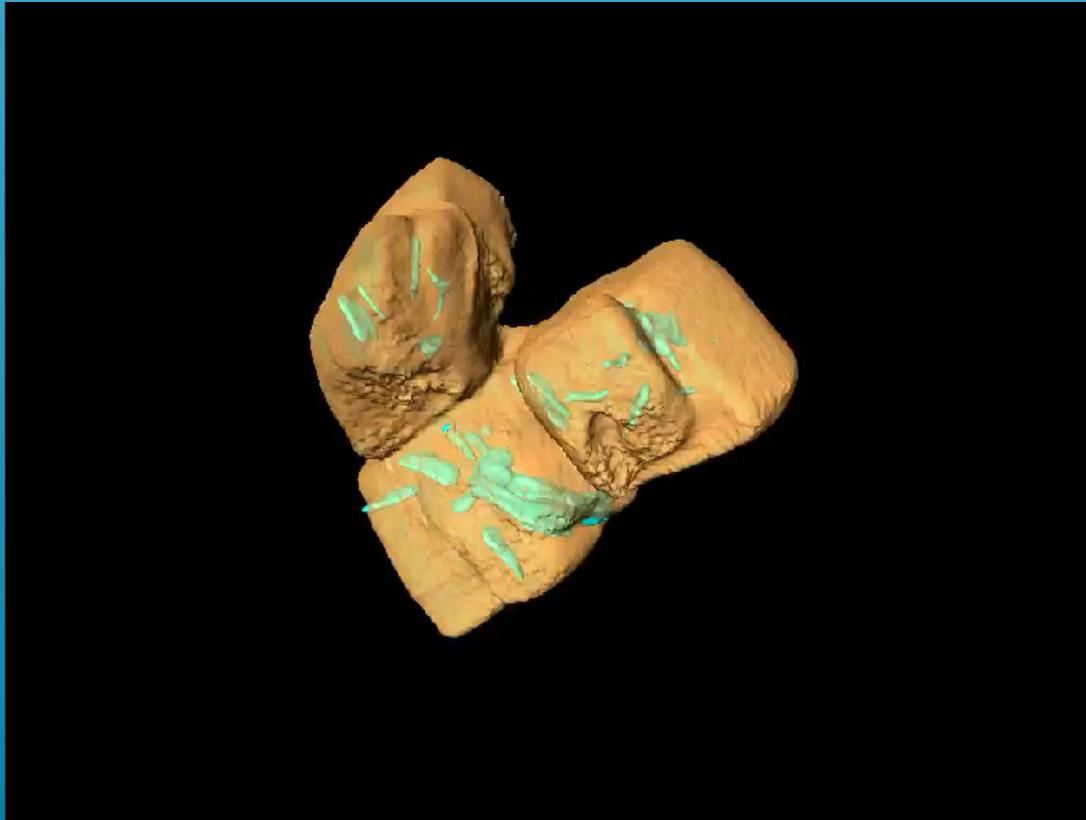
For Fe_2O_3 hematite:

$$a_B = \frac{(32)(9.11 \times 10^{-31})}{(1.43 \times 10^{-31})} (5.28 \times 10^{-11}) = 10.8 \times 10^{-9} \text{ m} = 10.8 \text{ nm}$$



Bose et al. (2009) *GCA*

Nano-hematite, HAADF-STEM tomography, aggregate, 30 nm



$$Rf = \int_L f(x, y) ds.$$

Radon J. (1917)
Leipzig Math.-Phys.

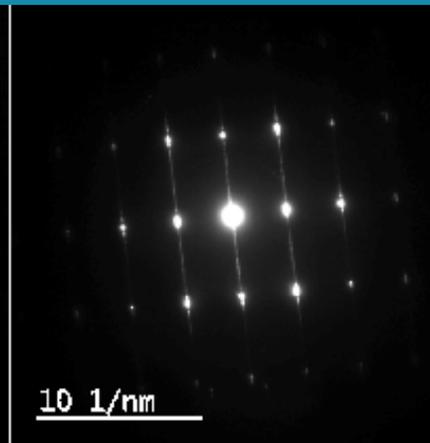
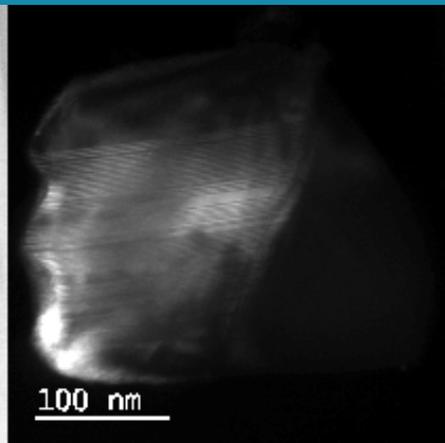
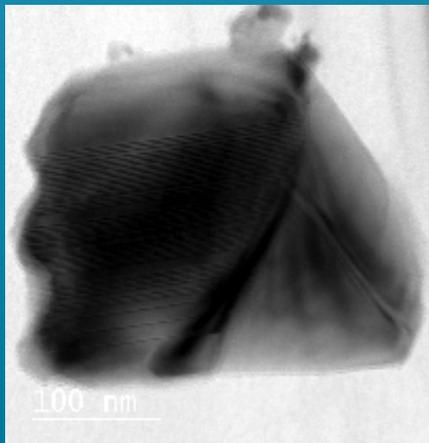
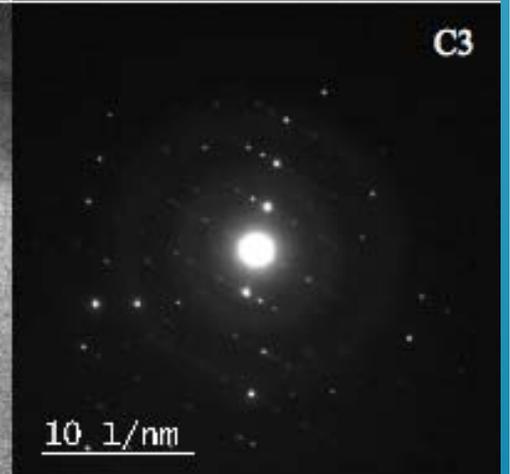
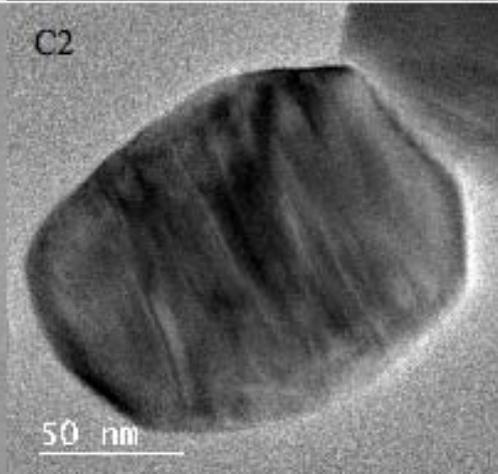
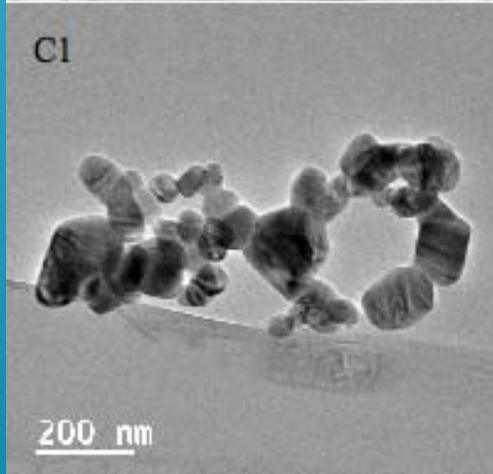
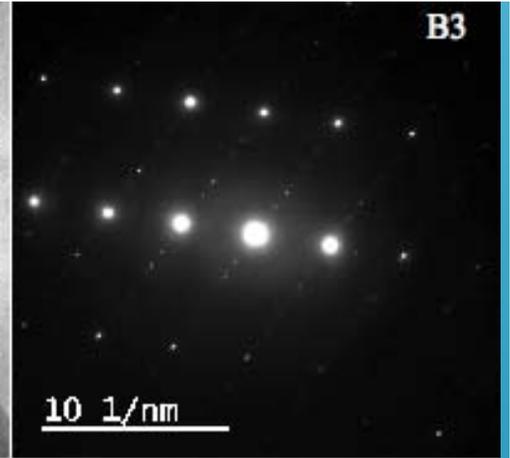
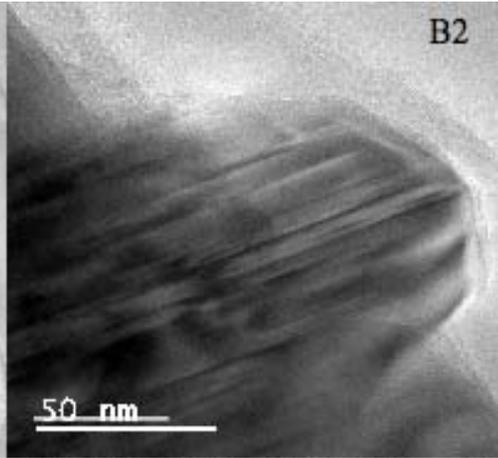
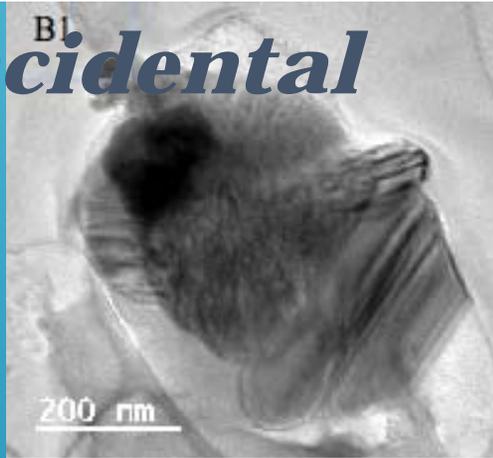
Echigo et al. (2013) *Am. Min.*



National
Nanotechnology
Coordinated
Infrastructure

Direct incidental

Magnéli
phases



- About NanoEarth: Facilities
- 21, 300 sq. ft. (up to 38,000 sq. ft.) of laboratory, instrument, & office space



VTSuN

Virginia Tech Center for Sustainable Nanotechnology



NCFL

Nanoscale Characterization and Fabrication Laboratory



● About NanoEarth: Facilities – VTSuN & NCFL



- Electron, x-ray, ion, photon beam instruments and more:
 - 4 TEMs, 2 SEMs, FIB, SIMS, XPS, Raman/AFM, 3 AFMs, UV-Vis-NIR, BET, DLS, UF
- Nanosynthesis, reactivity, sample prep
- Bio culturing and reactor facilities
- Aerosol chambers
- Field expertise, nano methods and tools

- First Year Activities: Users & Usage

- 280 Unique Users (NanoEarth: 81)

Total Instrument Usage Hours:

- All users: 7,627 hours (NanoEarth: 2,800 hr)
- External users: 16% (48 users) (NanoEarth: 46%, 22 users)
- External users lab hours: 19% (1,431 hr) (NanoEarth: 23%, 637 hr)

● First Year Activities: Establishing New Collaborations

● Research Universities (19)

- Duke University
- East Tennessee State University
- Georgia State University Geosciences & WIC
- Howard University
- Hampton University
- Kyushu University, Japan, URC and Dept. of Chemistry
- Laurentian University, Canada
- Montana State University
- Rutgers University
- University of Alabama
- University of Copenhagen, Denmark
- University of Delaware
- University of Kentucky
- University of Illinois, Chicago
- University of New Mexico
- University of South Carolina Geosciences & School of Public Health
- University of Texas, El Paso
- United States Geological Survey, Boulder
- Wichita State University

● First Year Activities: Establishing New Collaborations

● Community Colleges (2)

- City University of New York, Kingsborough Community College
- Virginia Western Community College

Four-year Liberal Arts Colleges (5)

- Hope College
- Longwood College
- Penn State Erie, The Behrend College
- Roanoke College
- Washington and Lee University

● First Year Activities: Industrial Engagement & Entrepreneurship

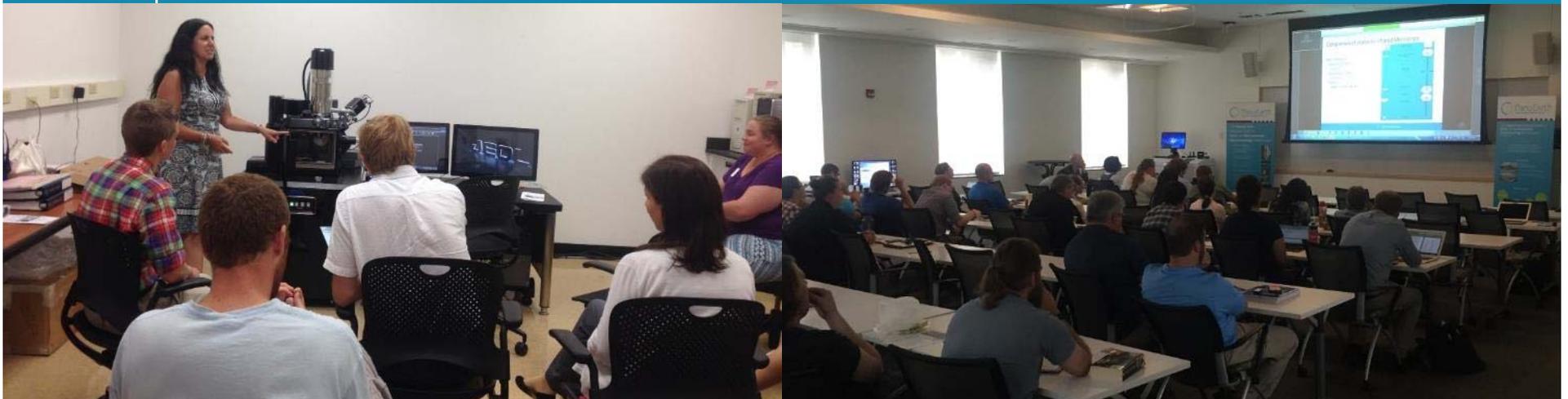
● ○ PHENOM – Public Health & Environmental NanOsysteMs Industrial Affiliates Program (IAP) at Virginia Tech

○ NanoEarth/Industry Joint Workshops:

▫ NanoEarth Summer School 

▫ Spectroscopic Solutions for Nanoscale & Compositional Analysis 

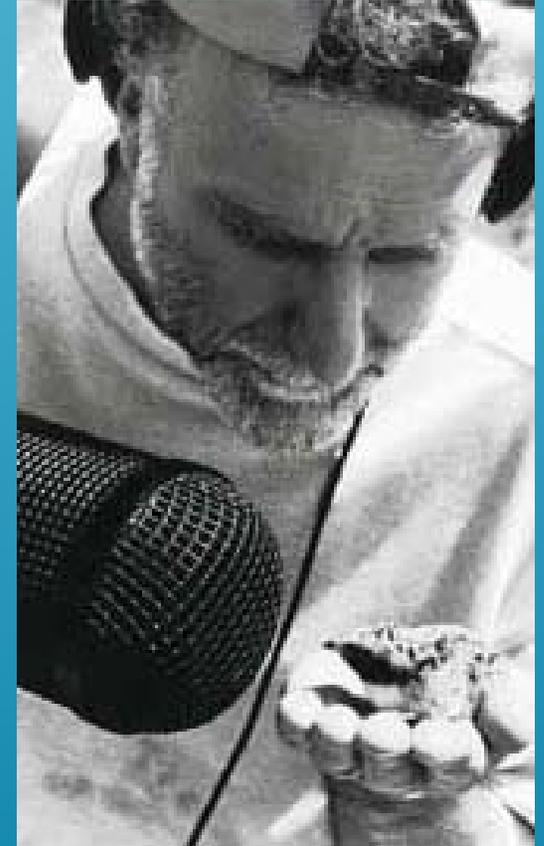
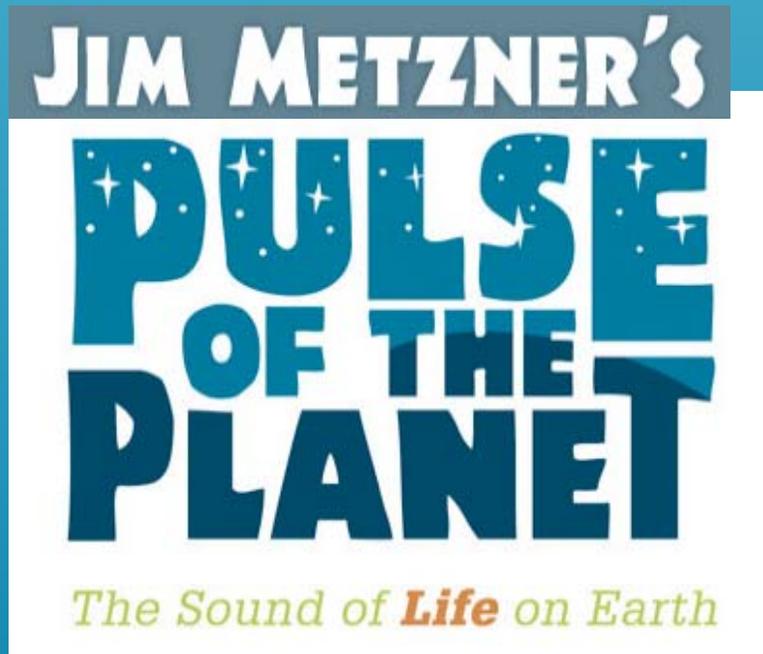
○ Instrumentation Addition: Empyrean XRD 



- NanoEarth Outreach:
MUNI (Multicultural and Underrepresented Nanoscience Initiative)
- Already received many new visitors (undergrad, grad, faculty) from:
 - Georgia State University
 - Howard University
 - Hampton University
 - University of South Carolina
 - City University of New York,
Kingsborough Community College



● NanoEarth Outreach: Pulse of the Planet



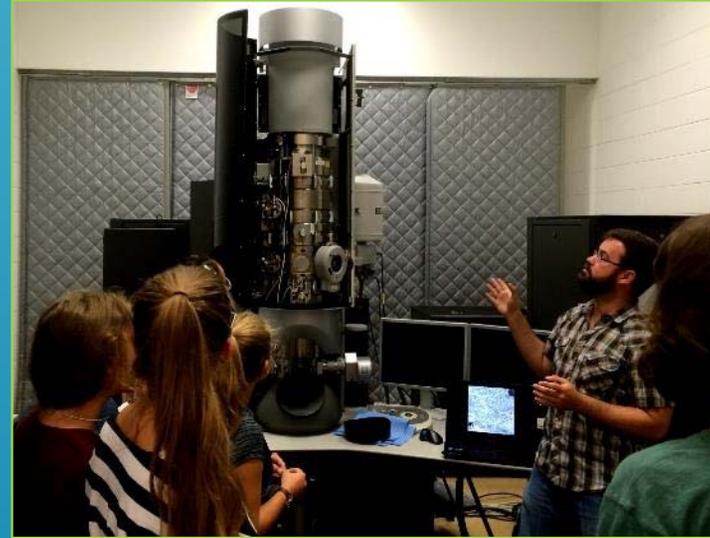
*Heard over 270 radio stations
by 1.1M listeners per week,
including Armed Forces Radio
and the World Radio Network*



NanoEarth Outreach: Activities



Virginia Tech Science Festival



Energy & Materials Discovery Camp



High School students from Japan

