NANO TECHNOLOGY (OUTLINES)

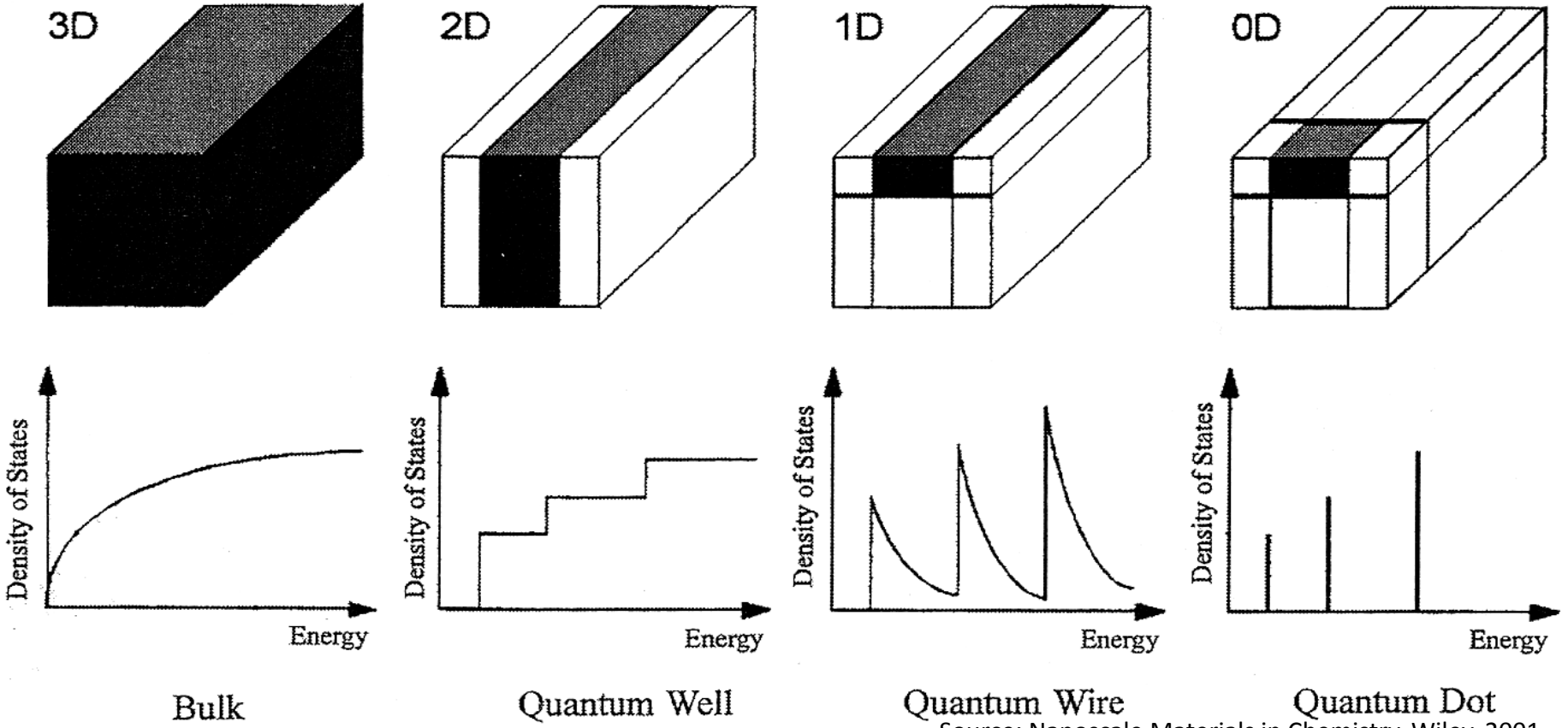
"Generally nanotechnology deals with structures of the size 100 nanometers or smaller in at least one dimension, and involves developing materials or devices within that size" Wikipedia

UNIT	ABBREVIATION	DESCRIPTION
Meter	m	~ 3 feet or ~1 yard
Millimeter	mm (10^{-3}m)	1/1,000 of a meter
Micrometer	µm (10^{-6}m)	1/1,000,000 of a meter, often called a micron
Nanometer	nm (10^{-9}m)	1/1,000,000,000 of a meter, the size of a single molecule

A NANO (NANOMETER)

= ~50,000 THINNER THAN HAIR

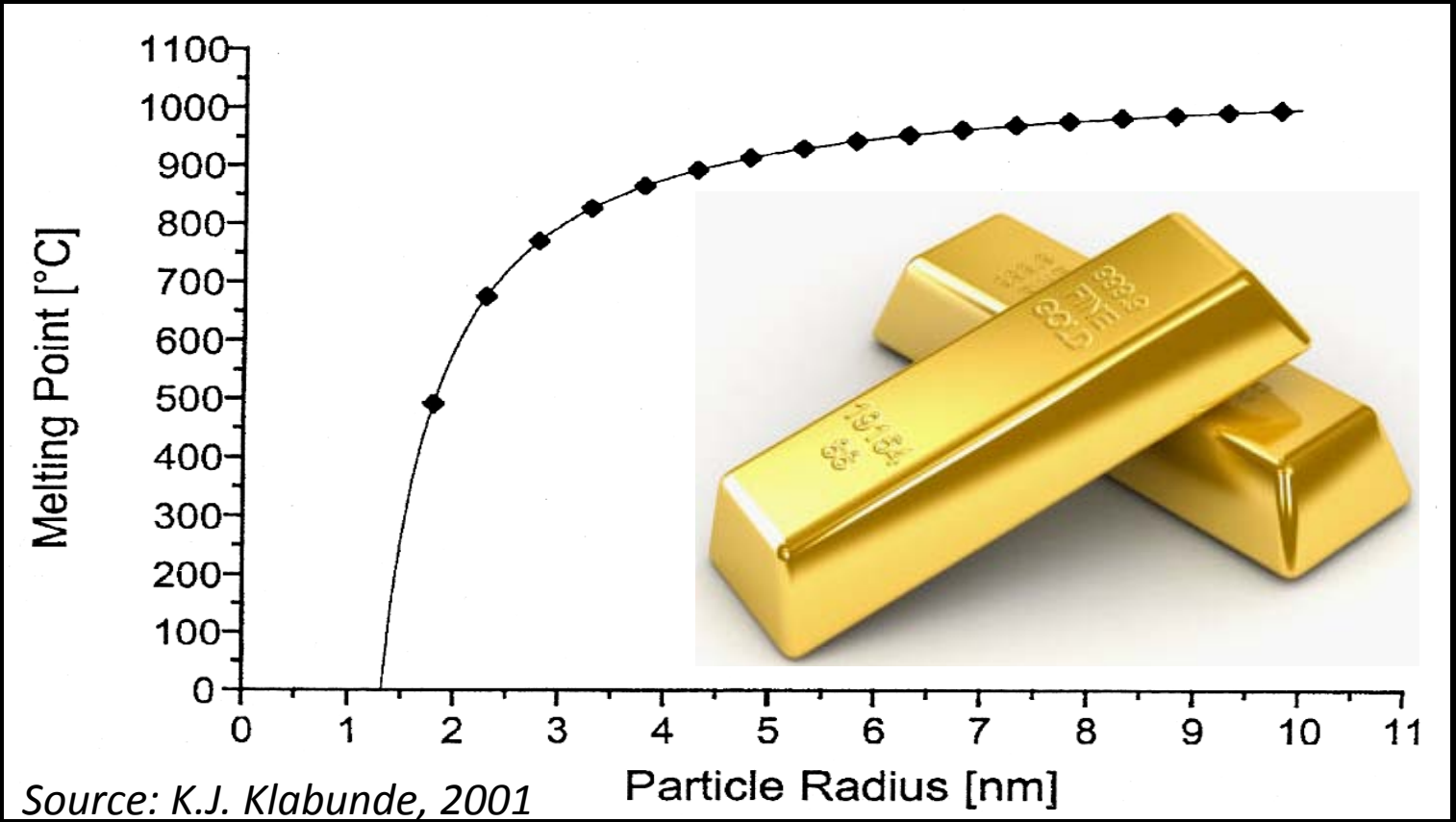
TWO, ONE & ZERO DIMENSION CONFINEMENT OF ELECTRON IN A METAL



Source: Nanoscale Materials in Chemistry, Wiley, 2001

If a bulk metal is made thinner and thinner, until the electrons can move only in two dimensions (instead of 3), then it is “2D quantum confinement.” Next level is ‘quantum wire. Ultimately ‘quantum dot’

MELTING POINT OF GOLD

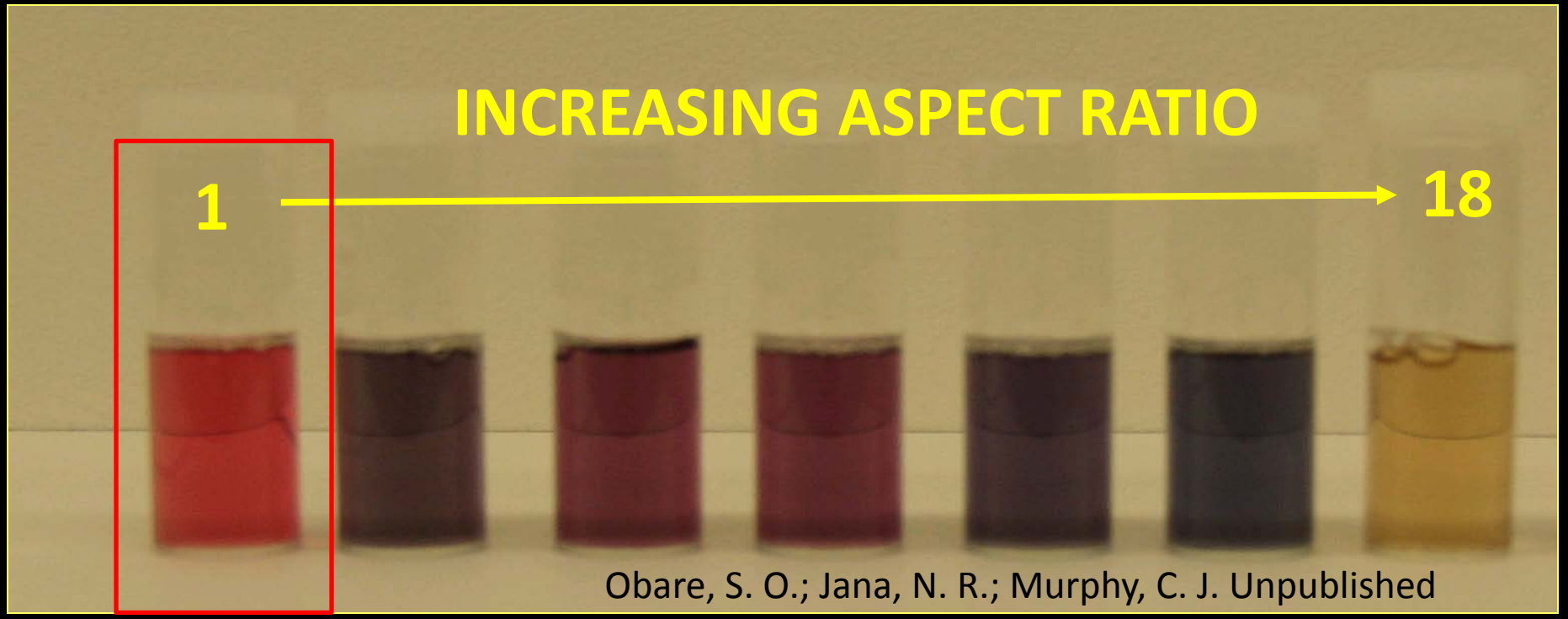


Source: K.J. Klabunde, 2001

Melting point of gold nano particles decreases rapidly as the particle size decreases from ~5nm to 1 nm. 1 nm particles of gold can behave like a liquid

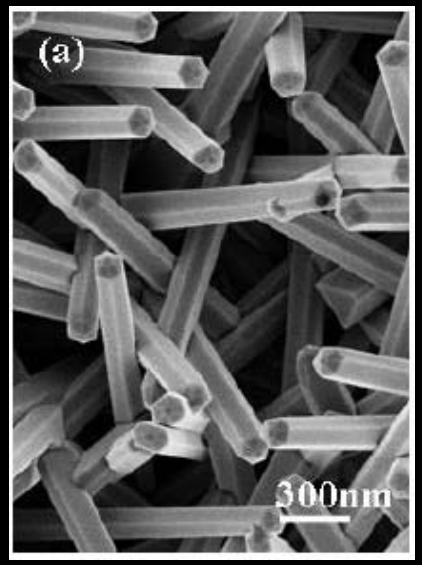
Color of GOLD NANOPARTICLES WITH INCREASING ASPECT RATIO

(Aspect ratio of nanoparticles: Ratio of surface to volume)

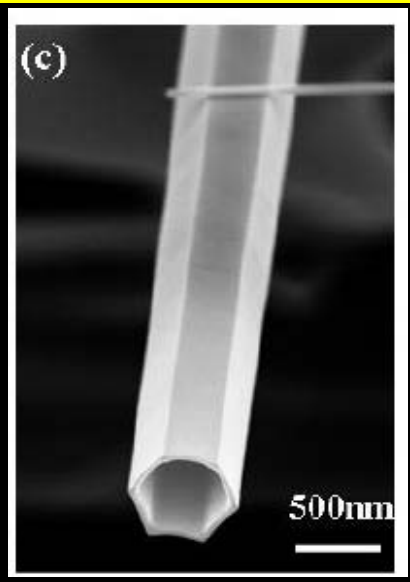


The color of gold nanoparticles also changes as the particle size decreases. Nano gold particles at aspect ratio of 1 are red in color

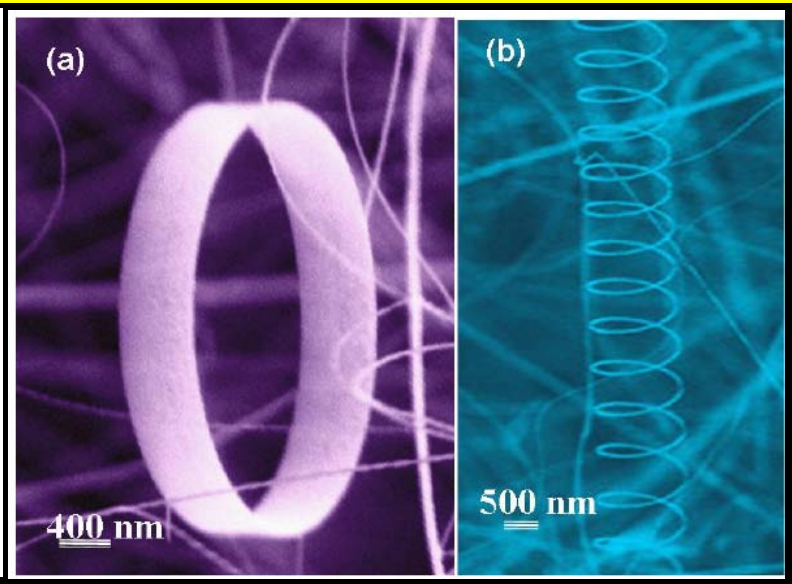
DIFFERENT SHAPES OF ZnO NANOSTRUCTURES



NANORODS



NANOTUBE



NANORING NANOSPRING

http://smartech.gatech.edu/handle/1853/7564

A 40-nanometer-wide NIST logo made with cobalt atoms on a copper surface.

http://pubs.acs.org/cen/news/8238/8238notw3.html

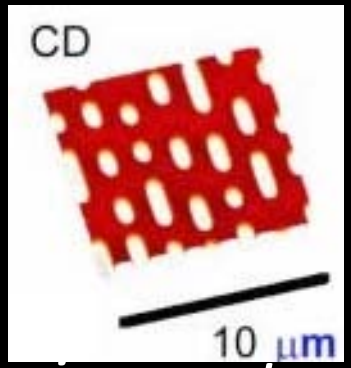
MATERIALS: STAIN RESISTANT CLOTHES & CARS

10 nm carbon fibers create cushion of air around fabric and act like peach fuzz

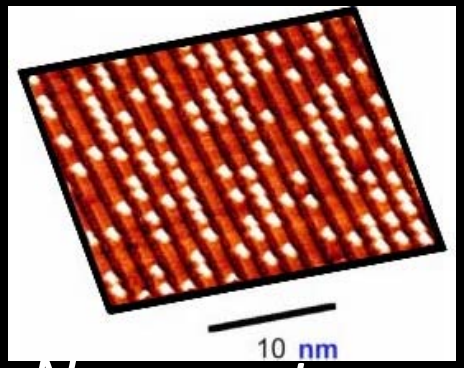
Protective nano-paint for cars. Water and dirt repellent, resistant to chipping and scratches

Sources: http://www.sciencentral.com/articles/view.php3?article_id=218391840&cat=3_5; http://mrsec.wisc.edu/Edetc/IPSE/educators/activities/nanoTex.html; http://www.supanet.com/motoring/testdrives/news/40923/

A DVD THAT COULD HOLD A MILLION MOVIES



micrometers



Nanometers

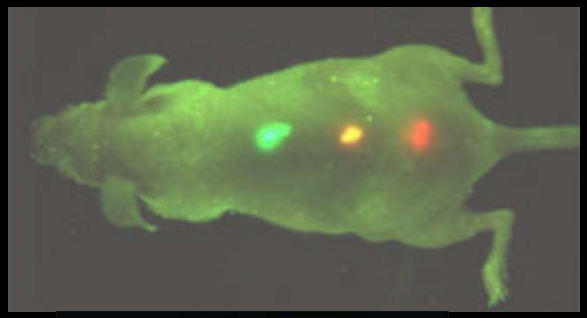
CD and DVD has 1,000 times more storage along each dimension (length, width) or 1,000,000 times greater storage density in total!

This effect, giant magnetoresistance (GMR) was recognized by the 2007 Nobel Prize in Physics.

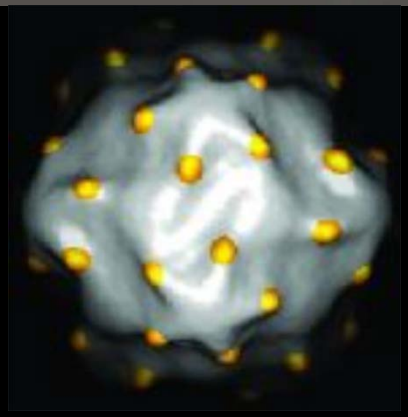
Magnetic coupling in multilayers (& permalloys)

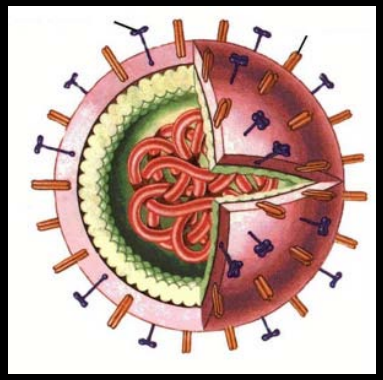
Sources: Himpsel et al., Advances in Physics **47**, 511 (1998); Magnetic Quantum Well States:Ortega et al., Phys. Rev. Lett. **69**, 844 (1992); Ortega et al., Phys. Rev. B **47**, 1540 (1993); Source: Images adapted from http://uw.physics.wisc.edu/~himpsel/nano.html

HEALTH CARE: DETECTION & TREATMENT

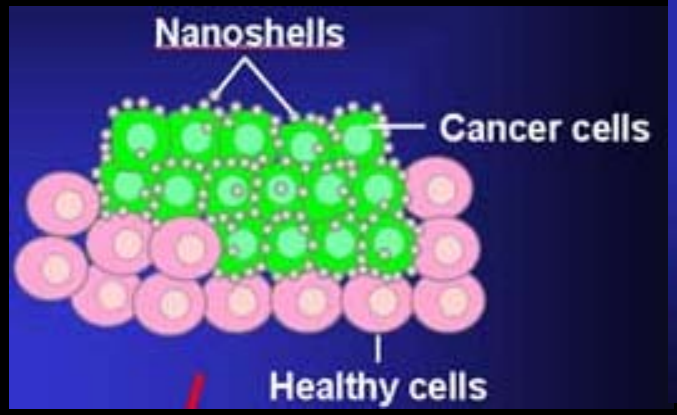


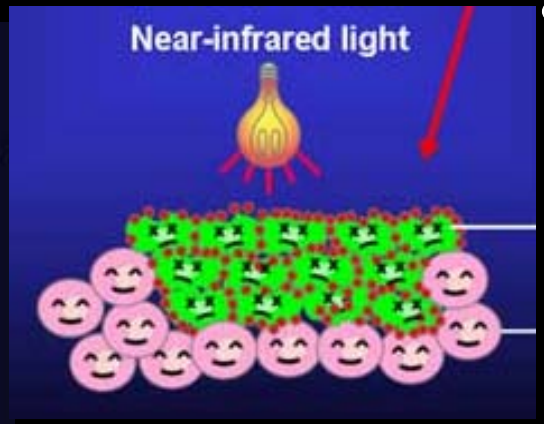
- Quantum dots get collected in tumors. They glow in UV light. 10-100 cancer cells can be detected.





- Gold nanocoatings on viruses could stop viruses from binding to cells. Never get another cold or flu?





- Nanoshells get selectively coated on cancer cells & can be selectively killed with a IR lamp

Sources: http://vortex.tn.tudelft.nl/grkouwen/qdotsite.html, http://www.whitaker.org/news/nie2.html
Sources: http://www.zephyr.dti.ne.jp/~john8tam/main/Library/influenza_site/influenza_virus.jpg

THE SIZE & SIGNIFICANCE OF NANOTECHNOLOGY

- The US 2010 budget provides ~$1.6 billion for the National Nanotechnology Initiative (NNI). The cumulative NNI investment since 2001, would total almost $12 billion. Global funding is much larger (http://www.nano.gov/html/about/funding.html)
- Almost every major university in the USA and many in Europe and Asia have a nanotechnology program
- $32 billion worth of products are now based on Nanotechnology. It is projected that by 2015, over a trillion dollars in global manufactured goods will incorporate nanotech or about 15% of total output (http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA471780&Location=U2&doc=GetTRDoc.pdf)

MOST OF US THOUGHT OF MAKING, UNDERSTANDING AND DEVELOPING PRODUCTS FROM NANOSTRUCTURES

HOWEVER

WE IGNORED UNDERSTANDING AND PRODUCTS THAT CAN BE DEVELOPED BY DESTROYING NANOSTRUCTURES

NANO-INDIS™

(INDICATORS BASED ON DESTRUCTION OF NANOSTRUCTURES)

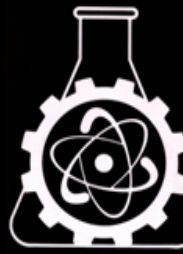
A REVOLUTION IN INDICATOR TECHNOLOGY

NANO-CONVERSION TECHNOLOGY

AN IGNORED BUT NOVEL AND UNIQUE FIELD OF NANOSCIENCE

FOR ADDITIONAL INFORMATION **CONTACT**:

Dr. Gordhan Patel, President
JP LABORATORIES, INC
120 Wood Avenue
Middlesex, NJ 08846
Phone: 732 469 6670
gnpatel@nanoconvertology.com
www.nanoconvertology.com
www.jplabs.com



Nano-Conversion Technology