



# Quantum Mechanics Meets Nanotechnology

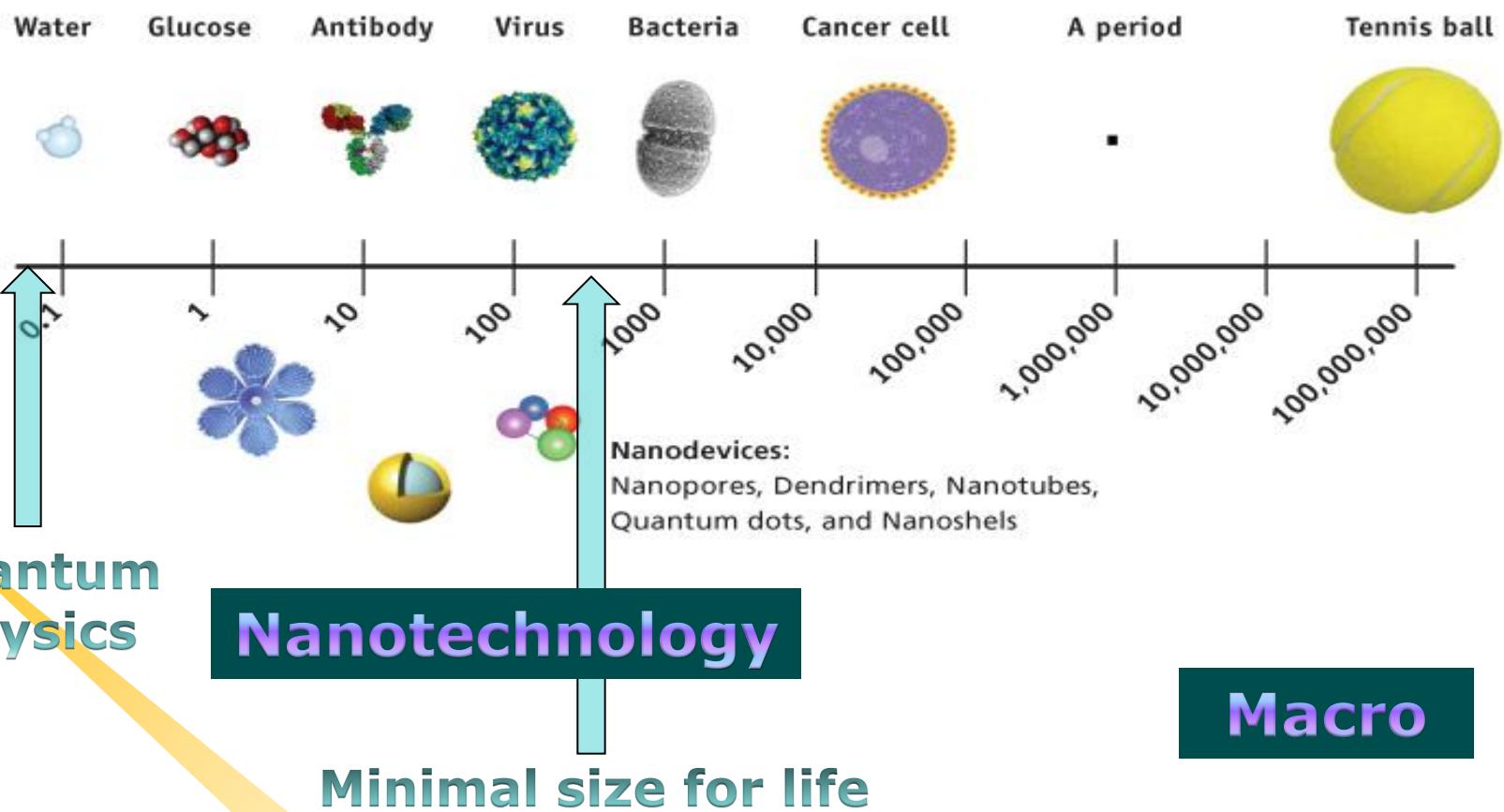
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Thresholds and New Dangers

*Andrew Linnell*

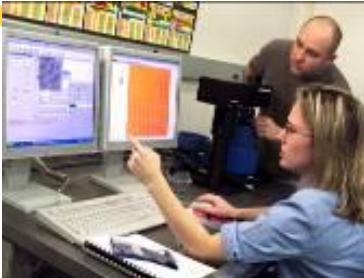
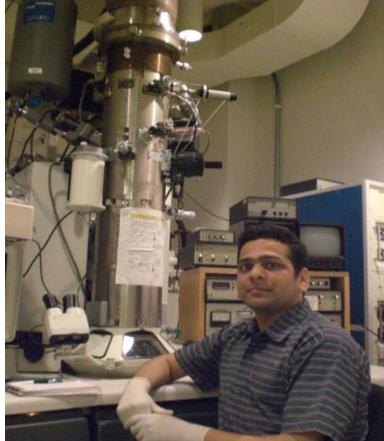
[jandrewlinnell@yahoo.com](mailto:jandrewlinnell@yahoo.com)

# Where is Technology Going? Invisible



<http://www.scientificamerican.com/article.cfm?id=are-viruses-alive-2004>

# How Do We Know They're There?

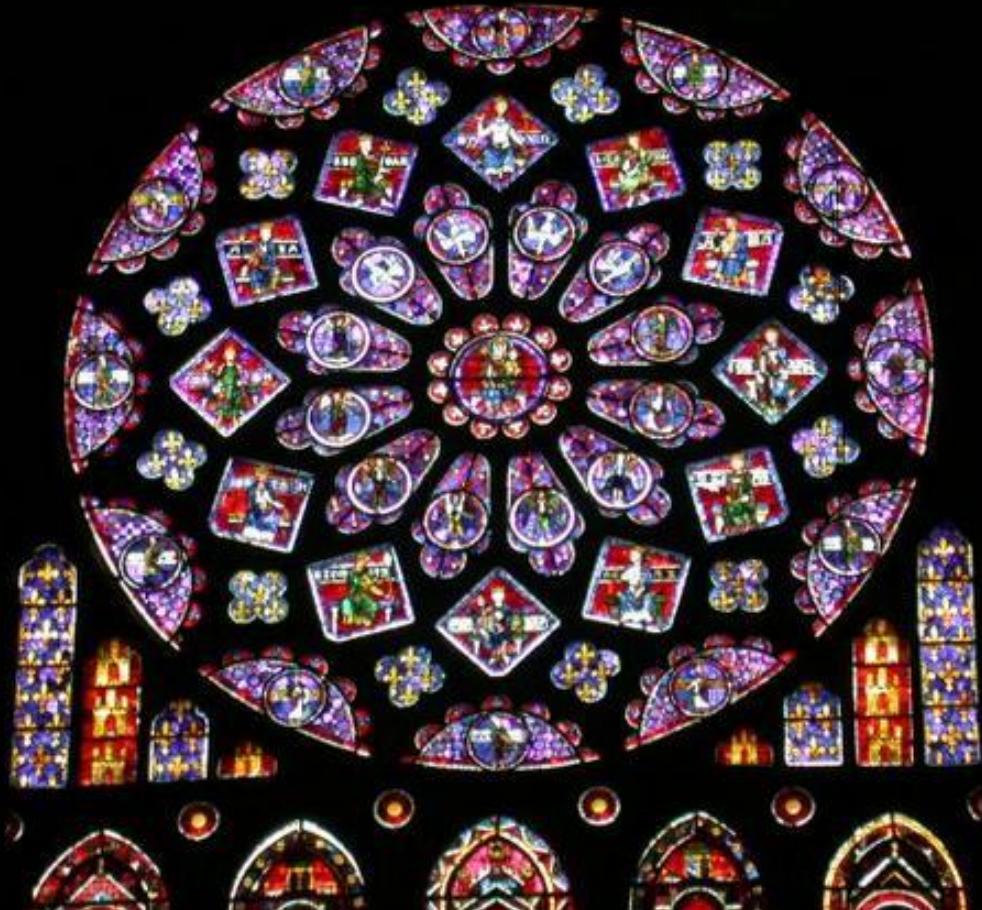
NANO-SCALE	MICRO-SCALE	MACRO-SCALE
<p><b>Nanometer Size Range</b> We can see with a <u>field emission electron</u> or <u>atomic force microscopes</u></p> 	<p><b>Micrometer Size Range</b> We can see with an <u>electron microscope</u></p> 	<p><b>Millimeter Size Range</b> We can see with an <u>optical microscope</u></p>  

Derived from <http://www.nano4me.org> Penn State University

# Nanotech Art: Deploying Luminosity

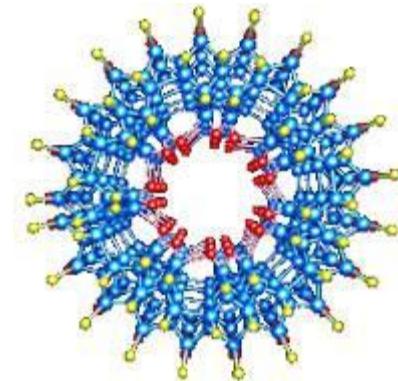
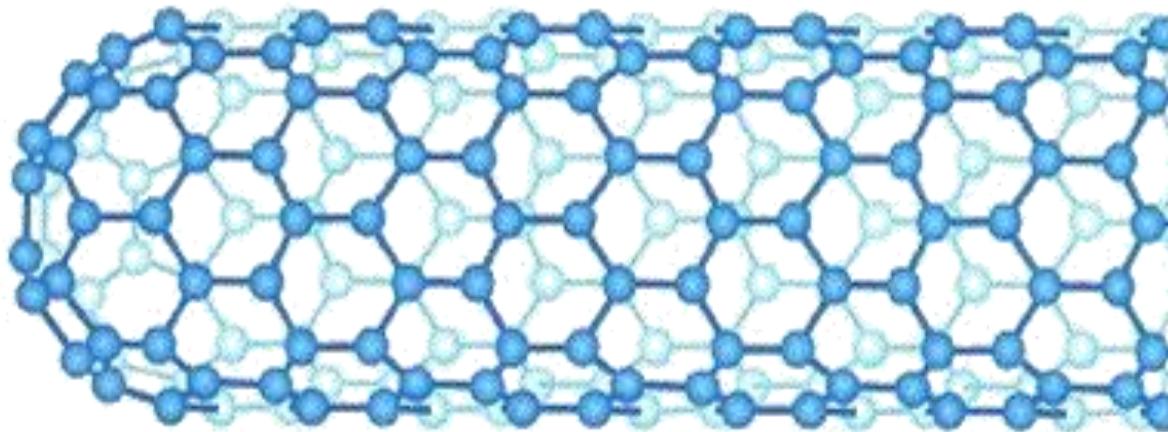


Canterbury Cathedral



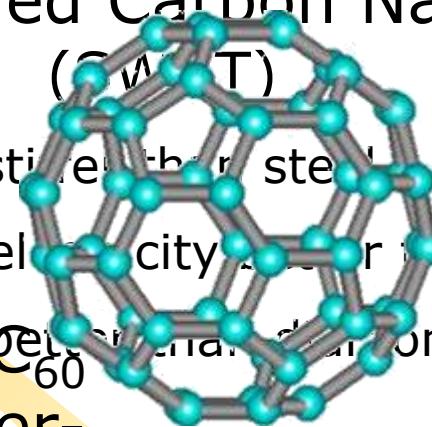
Chartres Rose window, c 1235

# Carbon Nanostructures



## Single-walled Carbon Nanotube (SWNT)

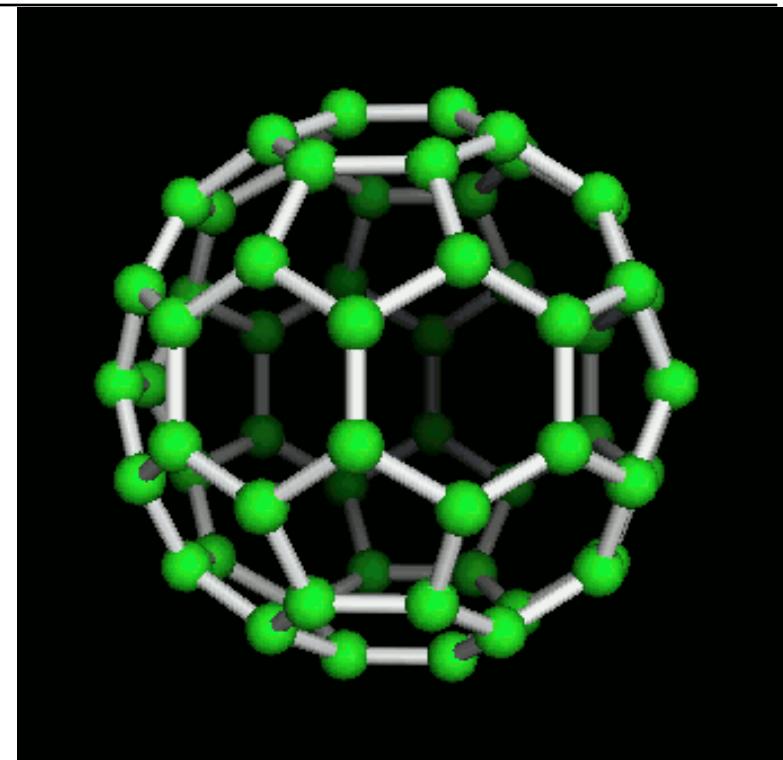
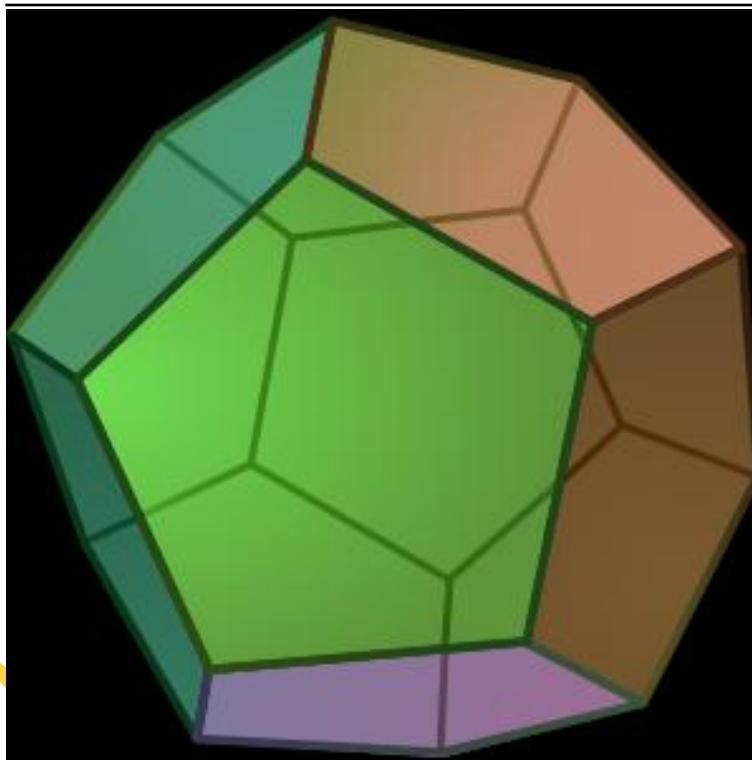
- Stronger and stiffer than steel
- They conduct electricity better than copper
- Conduct heat better than diamonds



(Buckminster-  
fullerene)

Philosopher's Stone

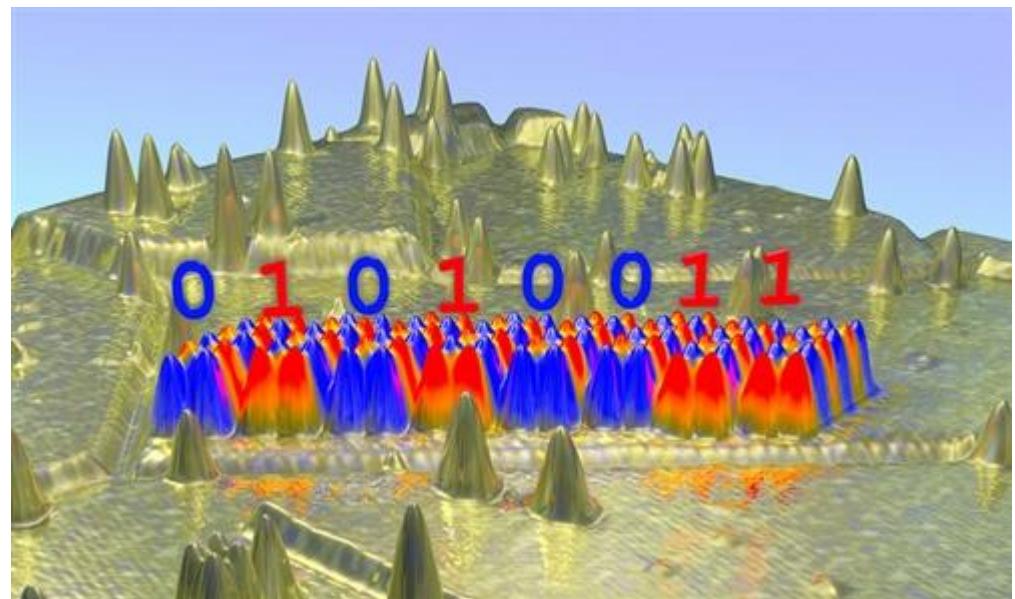
# The Dodecahedron and The Fullerene



# Recording Data

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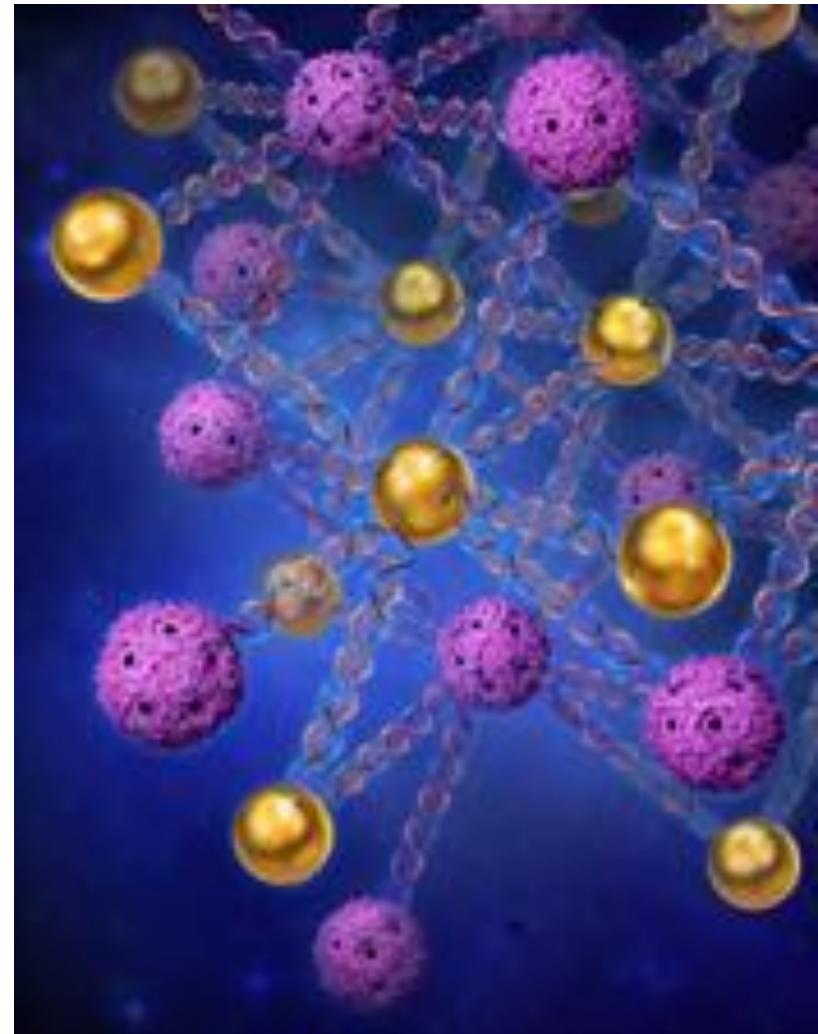
- Move from affecting the molecule to now the atom
- 12 Atoms per bit



# The Alchemy of Nanotechnology

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- A mix of nano gold and viral particles & DNA to bind them
- Diamond-like lattice
- Gold particles and viral particles **repel** each other, but their deterrence is countered by the **attraction** between complementary strands of DNA – nanotech's velcro!
- RS: physical repels while etheric sucks, absorbs



# Double Edged Sword

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- Promise and peril: Luddites or Technophiles
- Bill Joy, cofounder and Chief Scientist of Sun Microsystems
  - “We are being propelled into a new century with no plan, no control, no brakes! The only realistic alternative I see is relinquishment: to limit the development of the technologies that are too dangerous, by limiting our pursuit of certain kinds of knowledge.”  
[http://www.wired.com/wired/archive/8.04/joy\\_pr.html](http://www.wired.com/wired/archive/8.04/joy_pr.html)
  - Joy’s deep concern about the future grew out of Ray Kurzweil’s *The Age of Spiritual Machines*
- Kurzweil: “Technology has always been a **mixed blessing**, bringing us benefits such as longer and healthier life-spans, **freedom** from physical and mental drudgery, and many novel creative possibilities on the one hand, while introducing new dangers. Technology **empowers both** our creative and destructive natures.”
  - [http://wise-nano.org/w/Kurzweil\\_CTF\\_Essay](http://wise-nano.org/w/Kurzweil_CTF_Essay)

# Attack of the Nanobots!

- Deliver medicinal directly to affected area
- Repair internals non-invasively
- “Surgically” remove tumors
- Manufacturing
  - Personalized
  - Self replicating using DNA – thus low cost



# Designing Your Baby (Eugenics ?)



Eliminate defects



# Nanotech Dangers?

## No Regulations

- No agency owns
- Few toxicity studies

## Past Mistakes

- Asbestos
- Lead in petrol
- PCBs
- DDT - pesticides
- Synthetic hormones
- High fructose corn syrup
- Once in environment how is it removed?

**Wealth vs Safety  
Who will win?**



# Looking Young Again Creams

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- Dr. Perricone's anti-aging products **use Fullerenes** to carry active ingredients into the skin
- "These nanoparticles are extremely dangerous and products containing them should be banned," demands Dr. Samuel Epstein, M.D. of Environmental and Occupational Medicine at the University of Illinois at Chicago School of Public Health
- "The ultramicroscopic Fullerenes, also known as nanoparticles, have been **introduced without any labeling** into a growing number of Dr. Perricone's anti-aging products, particularly skin creams and Ceramic Eye Smoother. These are touted as reducing wrinkles and firming up the skin surface."
- <http://www.world-wire.com/news/1001120001.html>

# When Will Nano-Products Arrive?

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## They are already here!

- Stain-resistant fabrics
- Time-release perfumed fabrics
- Odor-eating socks
- Cosmetics & sunscreen
- Golf and tennis balls
  - Clubs and racquets
- Paints
- Self-cleaning glass
- Water purifiers
- Capsules carrying haemoglobin
- Water impurity testers
- Sprayable vitamins
- Ski wax
- Long-lasting paper
- Flat panel displays
- Flash memory devices
- Artificial silicon retinas
- Drug delivery systems
- Car parts
- Diagnostic agents for use in MRI scans

# Removable From Our Environment?

- No known effective method
- Nothing in Nature “knows” what these are
- No “predator” – nothing can digest them
- Only **fire** (Old Saturn) sufficient to break chemical bonds

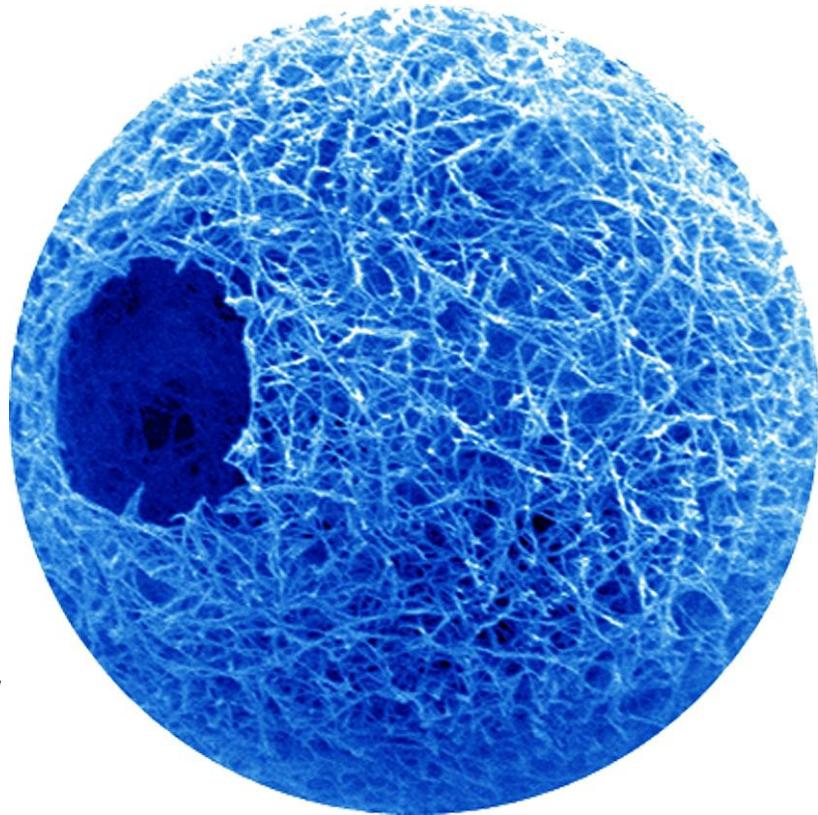
## Morgellons Disease -- Collembola

- Symptoms: crawling, biting and stinging sensations; granules, threads or black speck-like materials on or beneath the skin; and/or skin lesions



# Biodegradable Nanoparticles

- Star-shaped polymer can self-assemble into hollow, nanofiber sphere
- Inject into wounds, sphere biodegrades but the cells live on to form new tissue
- Nanofiber sphere as a cell carrier that simulates the natural growth environment of the cell
- Nanofiber repair group grew 3-4 times more tissue than the control group



<http://ns.umich.edu/htdocs/releases/story.php?id=8372>

# Edible Nanostructures?

- Crystals consisting of cubes made from six gamma-cyclodextrin molecules linked in three-dimensions by potassium ions

**EDIBLE CD-MOF**  
*A Metal Organic Framework prepared from completely edible materials.*

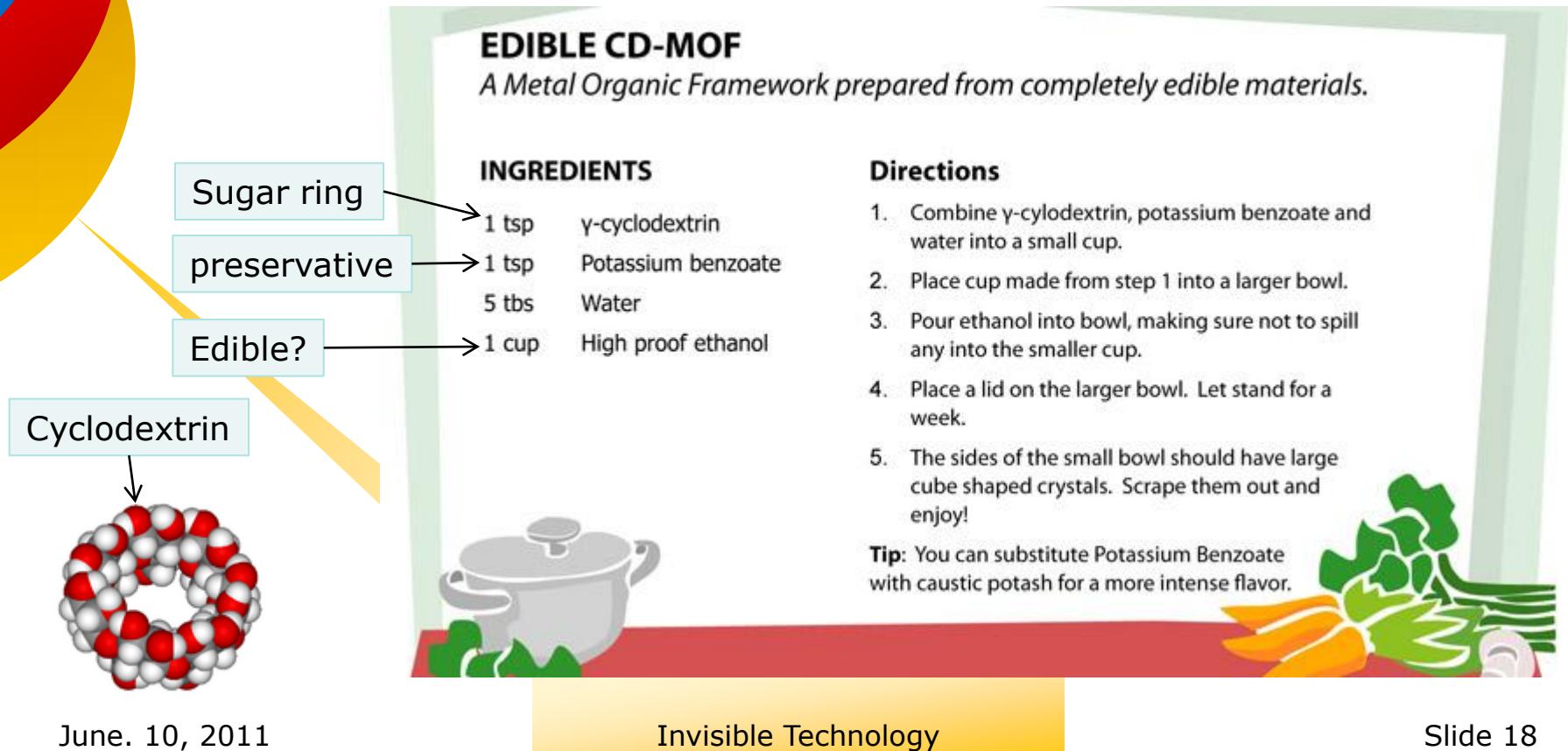
**INGREDIENTS**

Sugar ring	1 tsp	γ-cyclodextrin
preservative	1 tsp	Potassium benzoate
Edible?	5 tbs	Water
	1 cup	High proof ethanol

**Directions**

1. Combine γ-cyclodextrin, potassium benzoate and water into a small cup.
2. Place cup made from step 1 into a larger bowl.
3. Pour ethanol into bowl, making sure not to spill any into the smaller cup.
4. Place a lid on the larger bowl. Let stand for a week.
5. The sides of the small bowl should have large cube shaped crystals. Scrape them out and enjoy!

**Tip:** You can substitute Potassium Benzoate with caustic potash for a more intense flavor.





# Nano Toxicity

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Dangers and Moral Issues

# Toxicity of Nanoparticles

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- "This study was undertaken to address the current deficient knowledge of cellular response to nanosized particle exposure"
- <http://nanotoxcore.mit.edu/tox%20core/nano%20toxicity%20apers/Hussain,%20et%20al,%2006-17-2005.pdf> 25AUG2005
- Studies demonstrated that nanoparticle-exposed cells became abnormal in size, displaying **cellular shrinkage**, and an acquisition of an **irregular shape**
- Due to **toxicity of silver**, the results exhibited significant depletion of GSH level, reduced mitochondrial membrane function and increase in ROS levels, which suggested that cytotoxicity of Ag (15, 100nm) in liver cells is likely to be mediated through oxidative stress

- 
- Composed of light-absorbing, colloidal quantum dots linked to carbon-based fullerene nanoparticles, these tiny two-particle systems can convert light to electricity in a precisely controlled way. The first demonstration of a hybrid inorganic/organic, dimeric (two-particle) material that acts as an electron donor-bridge-acceptor system for converting light to electrical current

# Nanoparticle (NP) Toxicity

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1. "The general public needs to be aware that there are unknown risks associated with the products they buy containing nanomaterials," researchers Paul Westerhoff and Troy M. Benn said in a report scheduled for the 235th national meeting of the American Chemical Society (ACS).
  - Westerhoff and Benn report that ordinary laundering can wash off substantial amounts of the nanosilver particles from socks impregnated with the material. The Arizona State researchers suggest that the particles, intended to prevent foot odor, could travel through a wastewater treatment system and enter natural waterways where they might have unwanted effects on aquatic organisms living in the water and possibly humans, too.
  - <http://www.nanowerk.com/news/newsid=5208.php>
2. Metal- amended NMu exerts adverse effects on the growth and biomass production of plants.  
<http://pubs.rsc.org/en/content/articlelanding/2011/em/c0em00779j>

# Nanoparticle (NP) Toxicity

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- Wendelin Stark, a research chemical engineer at the Swiss Federal Institute of Technology in Zurich
- Stark and his colleagues tested compounds against human and rodent cells. They discovered the most acute toxic response of those studied. For instance, the iron oxide nanoparticles appeared astonishingly toxic, roughly as toxic as the crocidolite asbestos toward human cells. "That was very surprising," Stark said.
- The amount of iron oxide used in the nanoparticles for a toxic dose would itself not prove toxic if given in a completely dissolved form. This suggests there may be a toxic effect specific to nanoparticles, such as stress caused by the surface, size or shape of the particles, Stark explained.
- <http://www.physorg.com/news63466994.html>



# Nanoparticle (NP) Toxicity

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- Titania and zinc oxide nanoparticles are used on a large scale in sunscreens, pigments, and in tires or polymers as stabilizers. Zirconia and ceria nanoparticles have broad, rapidly growing applications in catalysis and polishing, and as additives in dental materials and polymers. Surface-coated iron oxide has repeatedly been proposed for use in magnetic drug targeting systems and MRI diagnostics. Tricalcium phosphate nanoparticles are often used in orthopedic implants.
- Moreover, the zinc oxide nanoparticles reduced cell proliferation more potently than asbestos did in rodent cells. Overall zinc oxide nanoparticles and asbestos drastically reduced human and rodent cell culture activity the most.
- <http://www.physorg.com/news63466994.html>

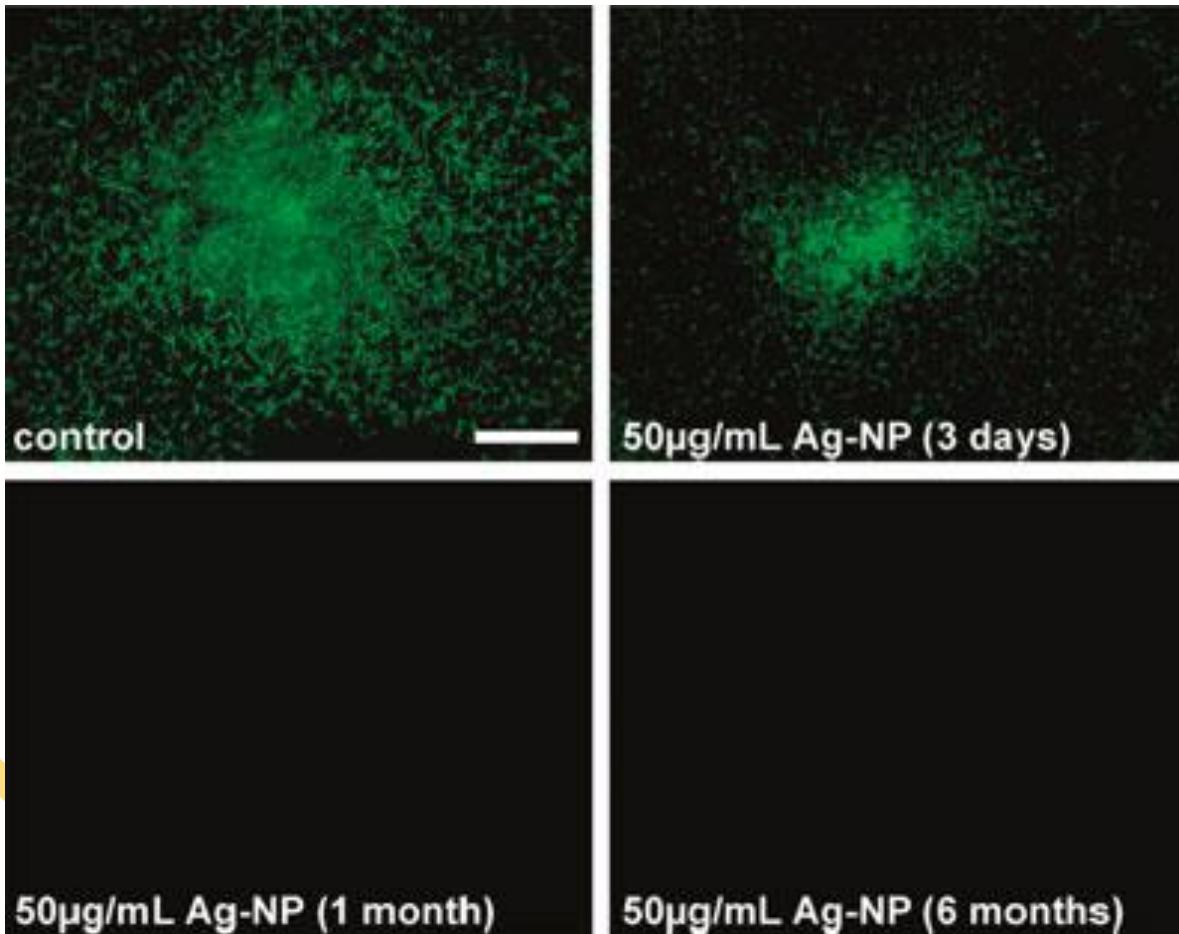


# Nanoparticle (NP) Toxicity

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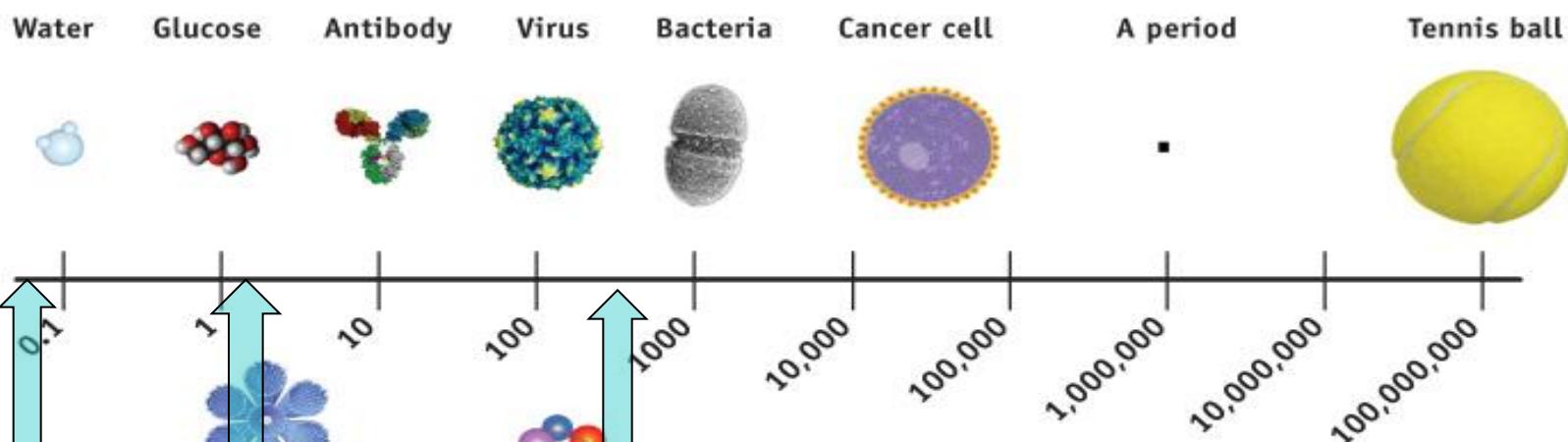
- “Nano-sized particles were more toxic than equal concentrations of micron-sized particles (for Ag NPs). Confirming previous studies, CeO<sub>2</sub> NPs were only toxic at concentrations significantly above environmentally relevant levels. The study also uncovered sub-lethal effects of silver nanoparticles, such as moulting and impaired growth of *D. magna*.”
- The flip side of silver's desired toxicity towards microbes is that it might have toxic effects for humans as well and this has raised debate about the safety of nanosilver products. Although scientists have worked to reduce the toxicity of antimicrobial nanosilver in products, concerns remain. Not helping to put these concerns to rest is a new report from a group of researchers in Germany that shows that toxicity of silver nanoparticles increases during storage because of slow dissolution under release of silver ions.

# Silver Nanoparticle Effect on Human Mesenchymal Stem Cells

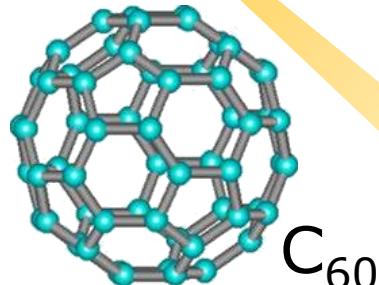


<http://www.nanowerk.com/spotlight/spotid=17687.php>

# Are These Thresholds?



Quantum  
Physics



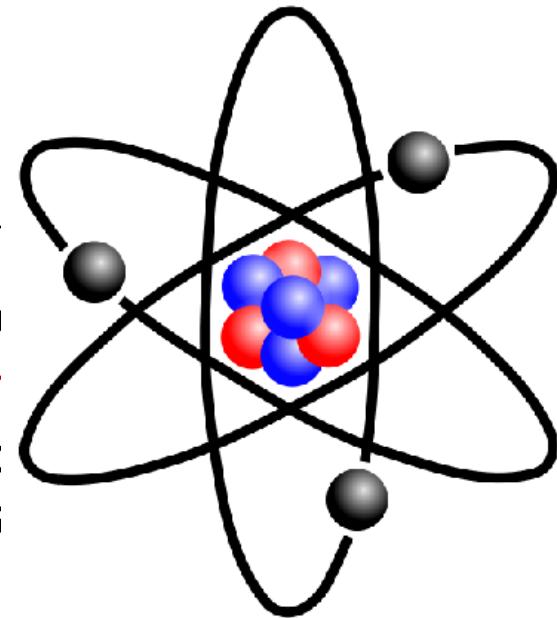
Nanotechnology

Minimal size for life

<http://www.scientificamerican.com/article.cfm?id=are-viruses-alive-2004>

# What is the Atom?

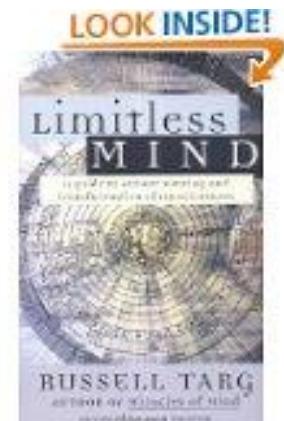
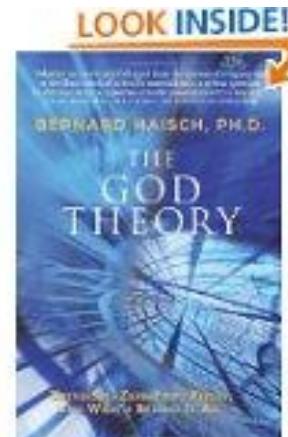
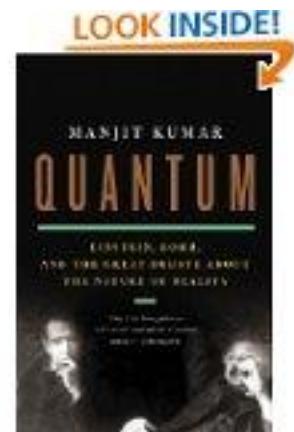
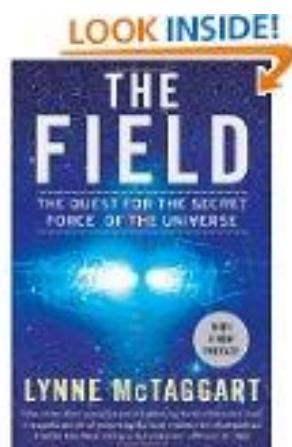
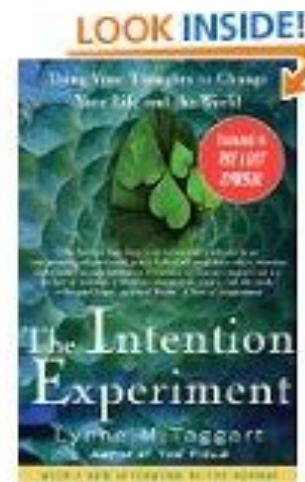
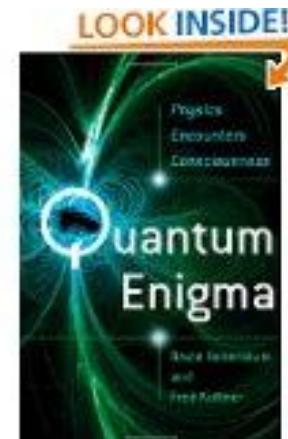
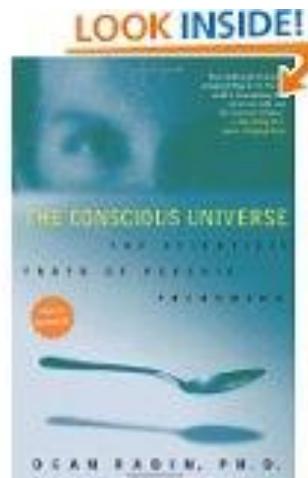
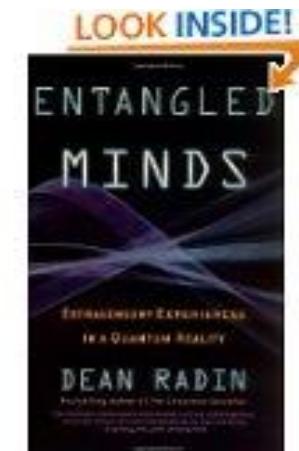
- **The atom is nothing but coagulated thought**
  - Thought itself is composed of the same elements as matter
- **Before** the end of the fifth epoch of the world, man will have reached the stage where man's thoughts will penetrate into the atom itself
- When the **similarity of substance between the thought and the atom** is once comprehended, the way to get hold of the **forces contained in the atom** will soon be discovered and then nothing will be inaccessible to certain methods of working
- It is impossible to conceive what might happen in such circumstances if mankind has not, by then, reached selflessness
- The **attainment of selflessness** alone will enable humanity to be kept from the brink of destruction



# Penetrating the Atom?

Three Generations of Matter (Fermions)			
	I	II	III
mass →	2.4 MeV	1.27 GeV	171.2 GeV
charge →	$\frac{2}{3}$	$\frac{2}{3}$	$\frac{2}{3}$
spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
name →	u up	c charm	t top
Quarks			
mass →	4.8 MeV	104 MeV	4.2 GeV
charge →	$-\frac{1}{3}$	$-\frac{1}{3}$	$-\frac{1}{3}$
spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
name →	d down	s strange	b bottom
Leptons			
mass →	<2.2 eV	<0.17 MeV	<15.5 MeV
charge →	0	0	0
spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
name →	$\nu_e$ electron neutrino	$\nu_\mu$ muon neutrino	$\nu_\tau$ tau neutrino
Bosons (Forces)			
mass →	0.511 MeV	105.7 MeV	1.777 GeV
charge →	-1	-1	-1
spin →	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$
name →	e electron	$\mu$ muon	$\tau$ tau
W <sup>+</sup> weak force			
mass →	80.4 GeV	—	—
charge →	$\pm 1$	—	—
spin →	1	—	—
name →	W <sup>+</sup> weak force	—	—

# Consciousness at the Quantum Level





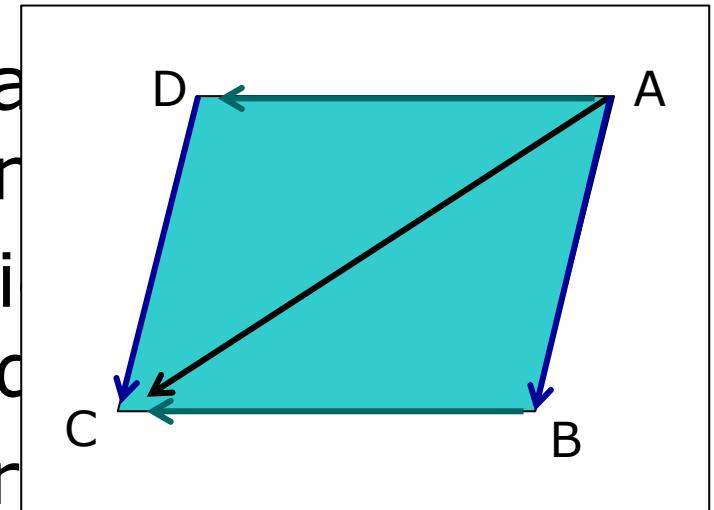
# Scientific Approaches

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1. Reductionism without whole-ism
2. Cause-effect, subjective-objective
  - Justified to eliminate the subjective?
  - Is matter really only objective?
  - Proceed from the known to unknown
3. Phenomena to Laws of Nature
  - Goethe: Metamorphosis of creatures and phenomena, no subjective-objective, no explanation of the unknown, rather the archetype.

# Measuring Nature

- Goethe: Phenomena indicate the Ur-phenomenon
- Science: mathematics something unrelated
- Arithmetic, geometry can be thought through without Nature
- You can reach movements but not forces with mental activity
- For forces, mechanics, you have to measure in the outer world





## Spiritual Science's Perspective

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- Light as consciousness
- Electricity as light in sub-nature
- As we penetrate into sub-nature, so must we in proportion rise into super-nature
- We must cultivate a science of the levels above and below the mere physical



# Spiritual Science's Perspective

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- Light as consciousness
  - “In Him was life, and the life was the light of men. And the light shone in the darkness yet the darkness comprehended it not.” – *John’s Prologue*
- Electricity as light in sub-nature
- As we penetrate into sub-nature, so must we in proportion rise into super-nature
- We must cultivate a science of the levels above and below the mere physical

# Particle Physics' Standard Model

## Background

Quantum field theory

Gauge theory

Spontaneous symmetry  
breaking

Higgs mechanism

## Constituents

Electroweak interaction

Quantum chromodynamics

CKM matrix

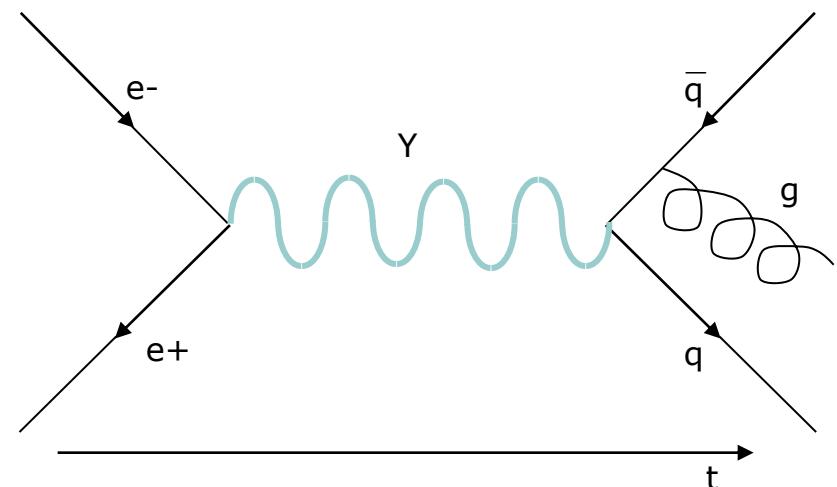
## Limitations

Strong CP problem

Hierarchy problem

Neutrino oscillations

## Feynmann Diagram Gluon Radiation

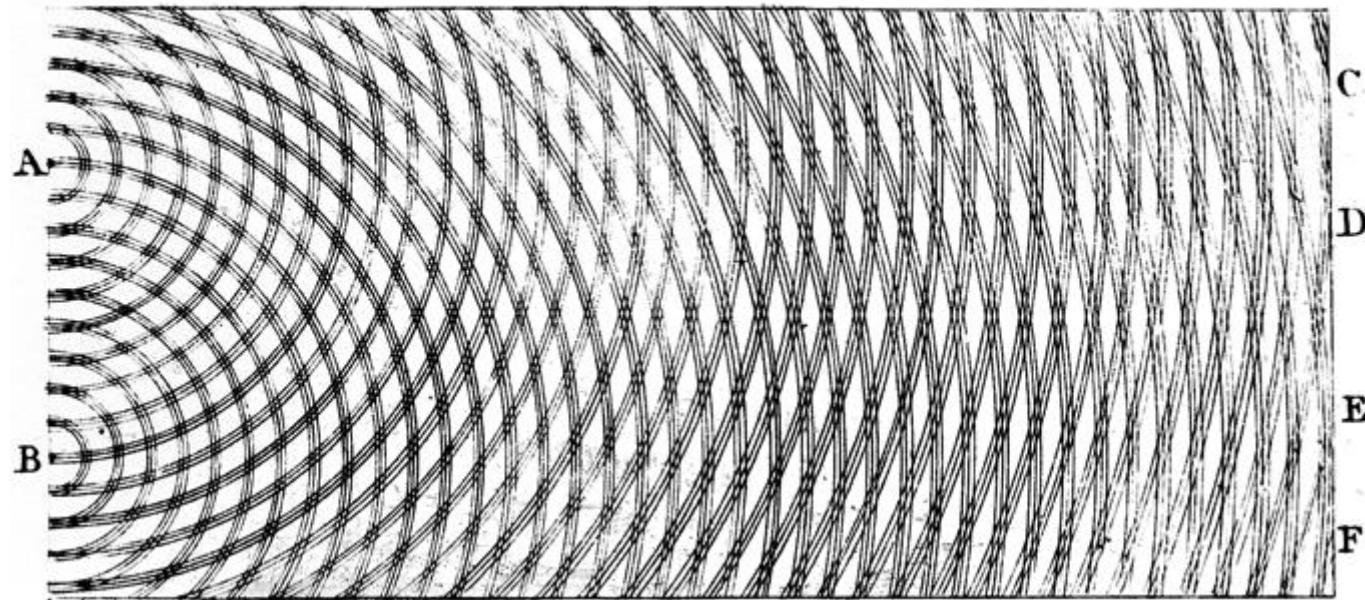


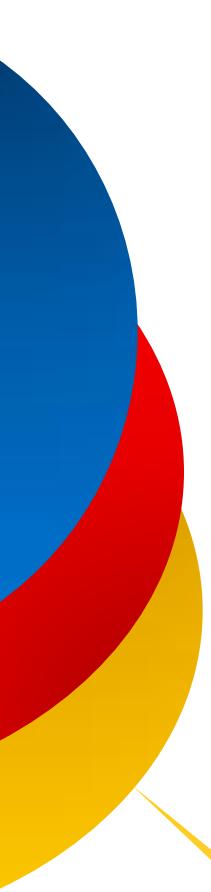
shows the radiation of a gluon when an electron and positron are annihilated

# Double-slit Experiment

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In 1805, Thomas Young showed that light acts as a wave, helping to defeat early particle theories of light





# Man and Light: Biophotons

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- Brain and nerves
  - Conduct electrons – and biophotons
- Discovered: all cells emit biophotons
  - Mitochondria contain chromophores
    - Are these “receptors”?
  - Why? Communicate?
- What is Light?
  - How is light related to the atom?
    - Or to electricity?

# Through Him All Things were Made

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- Mechanical phenomena must be tested in the outer world
  - Must be mass at point A
- Not the case with kinematics which needs no body to think through
- Molecular mechanics
- Atomic mechanics
- Quantum mechanics
- Centric forces – lifeless realm



# In Him Was Life

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- You cannot understand life if you restrict yourself to centric forces
- For the living, I must go to the 'ends of the world' to all the points at the periphery to see how their interplay unites within the living.
- Like the leap from Kinematics to Mechanics is the leap from lifeless to living – to the incalculable – cosmic
- ONLY the man-made is only lifeless
- Question: is theory of Gravity correct?

# Call to Action

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- Nanotechnology is a dangerous frontier
  - We must not lose what it is to be a Human
  - We must develop Masonry of Sub-Nature
    - Temple Mystery of Hiram and Solomon, Trismegistus
- Must balance sub-Nature with super-Nature
  - Spiritual Science
- Battle for the Life Realm (formative forces)
  - Role of Art
  - Role of Religion
- Waldorf students to the rescue!
  - New Image of the Human