

Mechanics Scholars Luncheon

Texas A&M University



Opportunities for Talented People with Physics Training

David Toback

Department of Physics and Astronomy

Texas A&M University

E-mail: toback@tamu.edu

<http://faculty.physics.tamu.edu/toback/>

Good news and Bad news

- **Good news**

- You have been identified as being in the top 2% of all physics performers in Physics 218
- You get a free lunch

- **Bad news:**

- You clearly have the talent and the “right stuff” to get further training in physics
- You have to listen to me give a pitch on why you should SERIOUSLY think about taking more physics classes

Common Myths

I'd like to start by listing some common myths

1. People

- *I don't know ANYONE who does physics except my high school teacher and my Professor from this last semester*
- *Frankly, they're kinda dorky and weird like on Big Bang Theory*

2. Jobs:

- *My high school advisor said "You're good at math and science? You should be an engineer!"*
- *If you have a physics degree, you can either be a professor or a high-school teacher. Either do research or teach*
- *Physics is all theory, engineering is where you do REAL things*

Common Myths cont...

More common myths

3. *Money:*

- *All the people I know with physics degrees don't dress well so they must be poor*
 - *Have you seen the car they drive?*

4. *Uhhh... Physics? Really?*

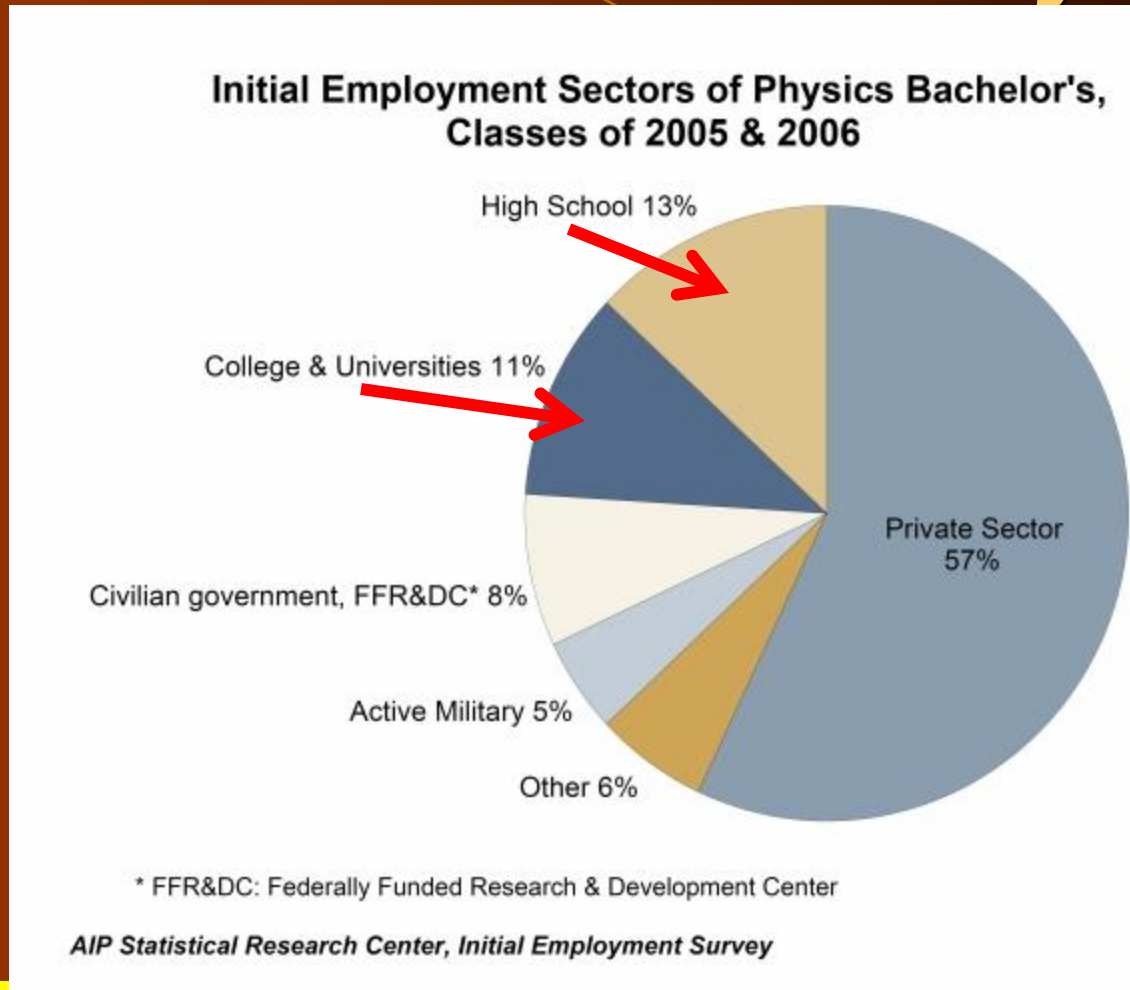
- *What do people who get physics degrees DO anyway?*
- *I've heard about some cool physics things but they aren't relevant to the "real world"*
- *The cool stuff isn't covered in any of the classes*

Warning: My answers may be more blunt than you wanted...

Let's talk *Jobs* and *Money*
first

**After I've convinced you not
to worry, then we can talk
about the fun stuff...**

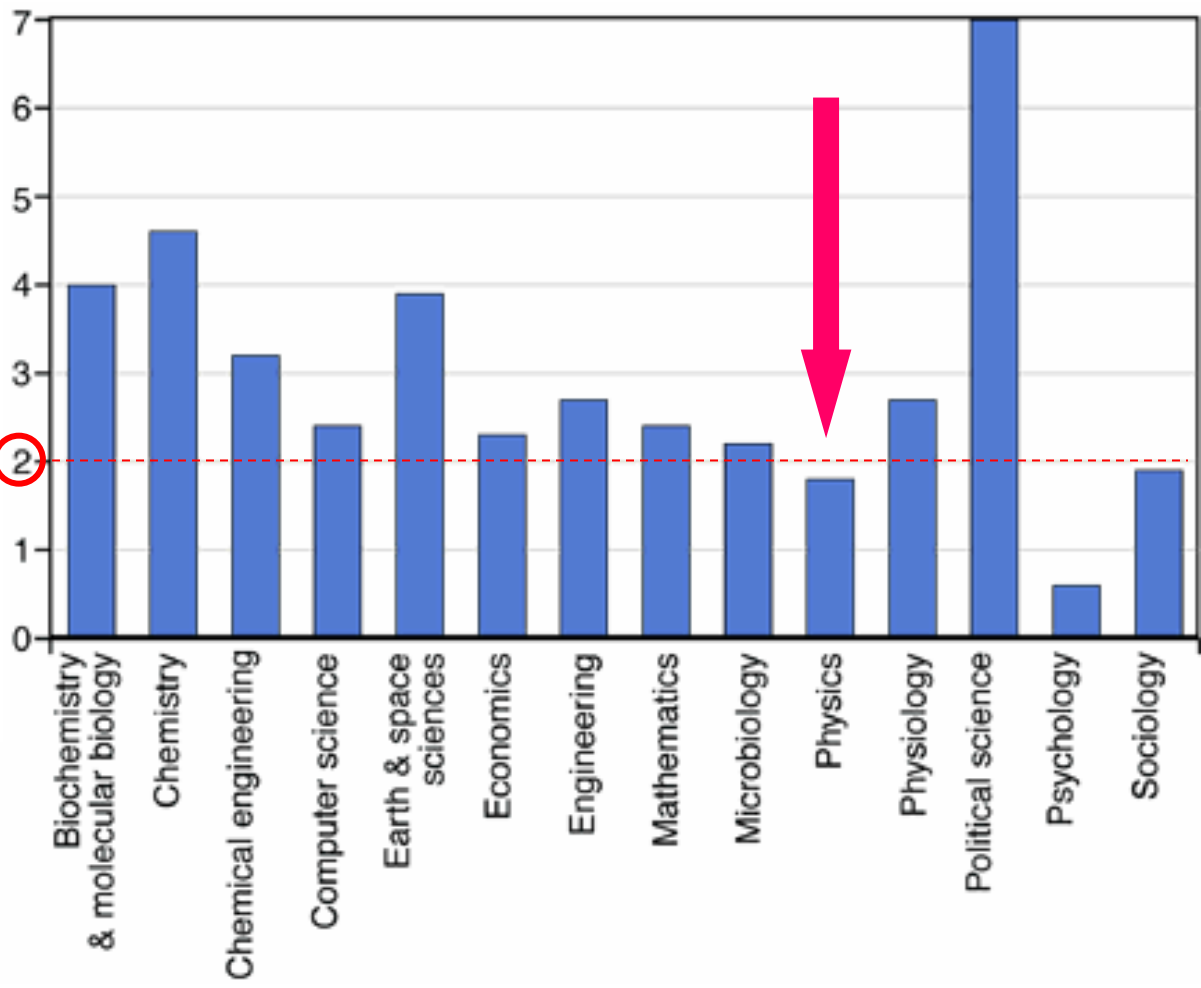
High School Teacher or a Professor only? No!



People who say that don't know what they were talking about!

High Unemployment? Fact or Fiction?

Unemployment rate in Percent



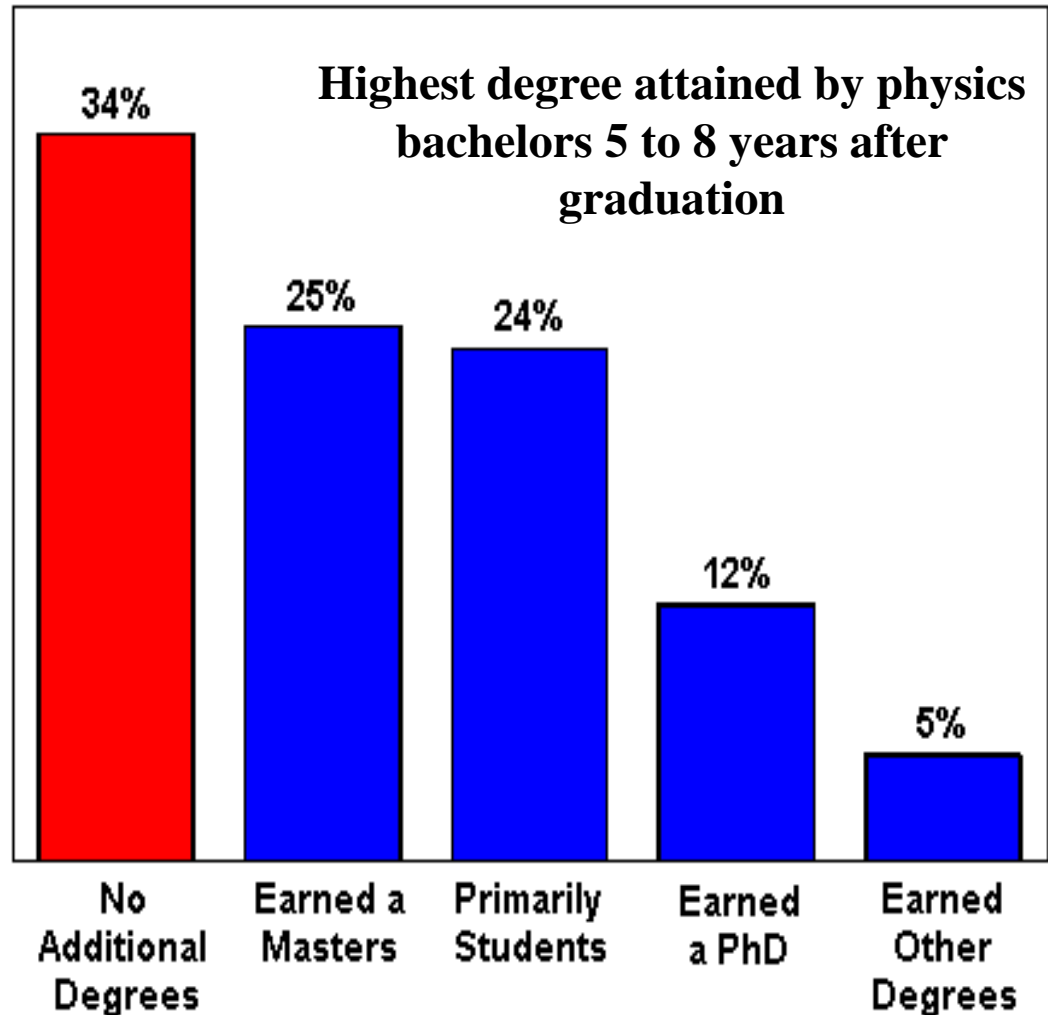
*Ok... what kind
of job?*

**Depends on what kind of
degree you get... let's do them
one at a time:**

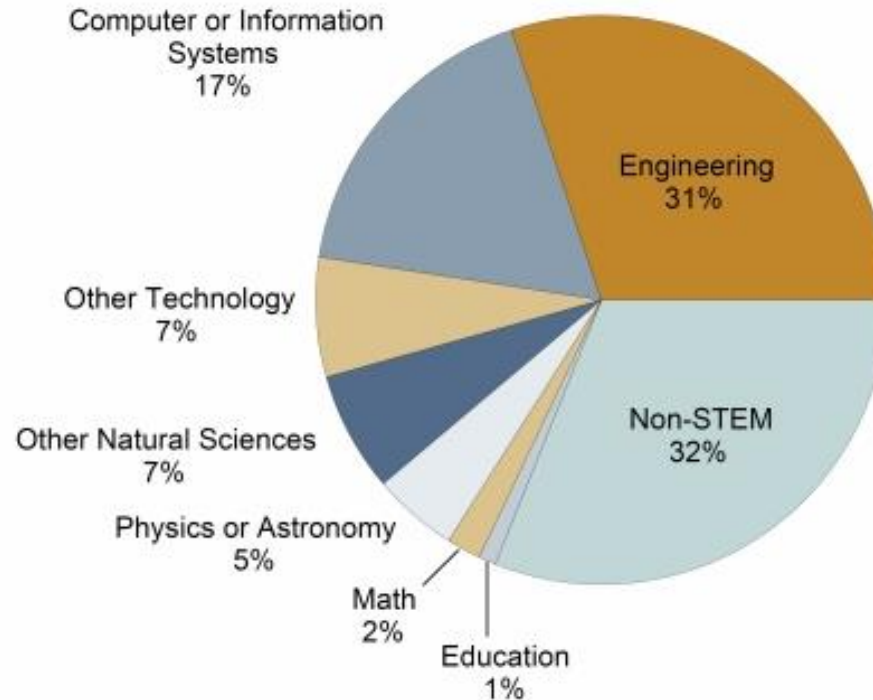
- Bachelors**
- Ph.D.**

Ok... Lets say I get a bachelors... then what?

Most people go on to get advanced degrees, but many get jobs right out of college



Field of Employment for Physics Bachelors in the Private Sector, Classes of 2005 and 2006



STEM: Science, Technology, Engineering and Math

AIP Statistical Research Center, Initial Employment Survey

***Ok... What
can you do
with a
bachelors
degree?***

Who's going to hire me?

Companies hiring people with physics degrees in Texas

Advanced Micro Devices
Alcatel
Allstate Insurance Company
Alpha Sim Technology, Inc.
Avant! Corporation
Ball Semiconductor, Inc.
Boral Material Technologies
Camp, Dresser & McKee
Control Systems International
Cypress Semiconductor
Dell Computers
DRS Technologies, Inc.
Fairfield Industries
Helena Laboratories Corporation
Insurdata
Kellogg, Brown & Root
Kelly Scientific Resources
Law Office of Robert Swafford
Litton-TASC, Inc.

Litton-TASC, Inc.
Lockheed Martin
Milsoft Integrated Solutions
Mobilestar Network
Motorola
National Instruments
National Semiconductor Corporation
Nortel
PGS Tensor
Radiant Photonics
Raytheon
Reltec Corporation
Sercel, Inc.
Sony Semiconductor
Southwest Research Institute
Technical Alliance Recruiters
Traas Ionics Corporation
United Space Alliance
Verizon Wireless

Q: Is the money any good compared to other majors I might choose?

A: Yup!!!

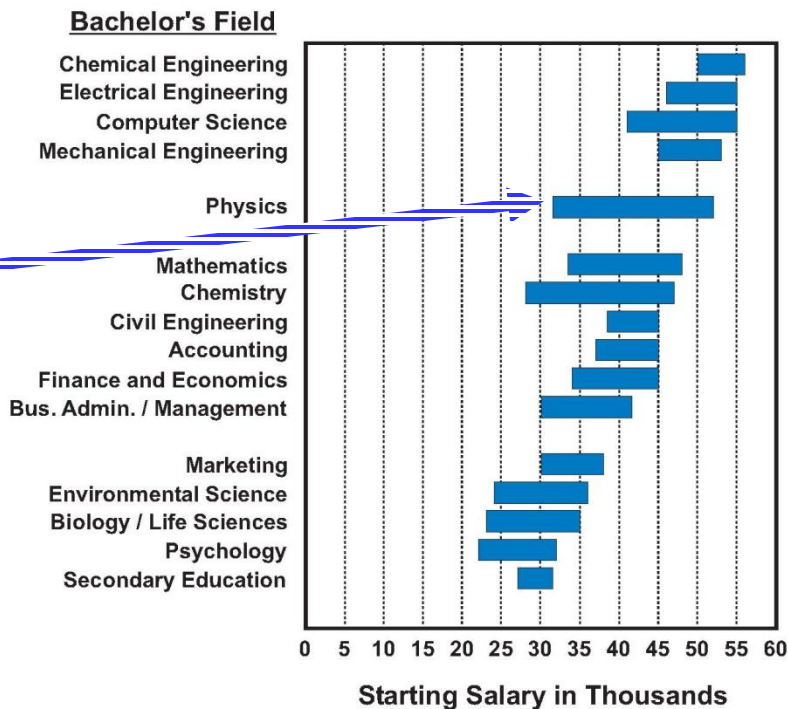
PHYSICS TRENDS

Contact: Patrick J. Mulvey
pmulvey@aip.org

Fall 2003

What's a Bachelor's Degree Worth?

Typical Salaries Offered by Campus Recruiters, 2002-2003



Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles.

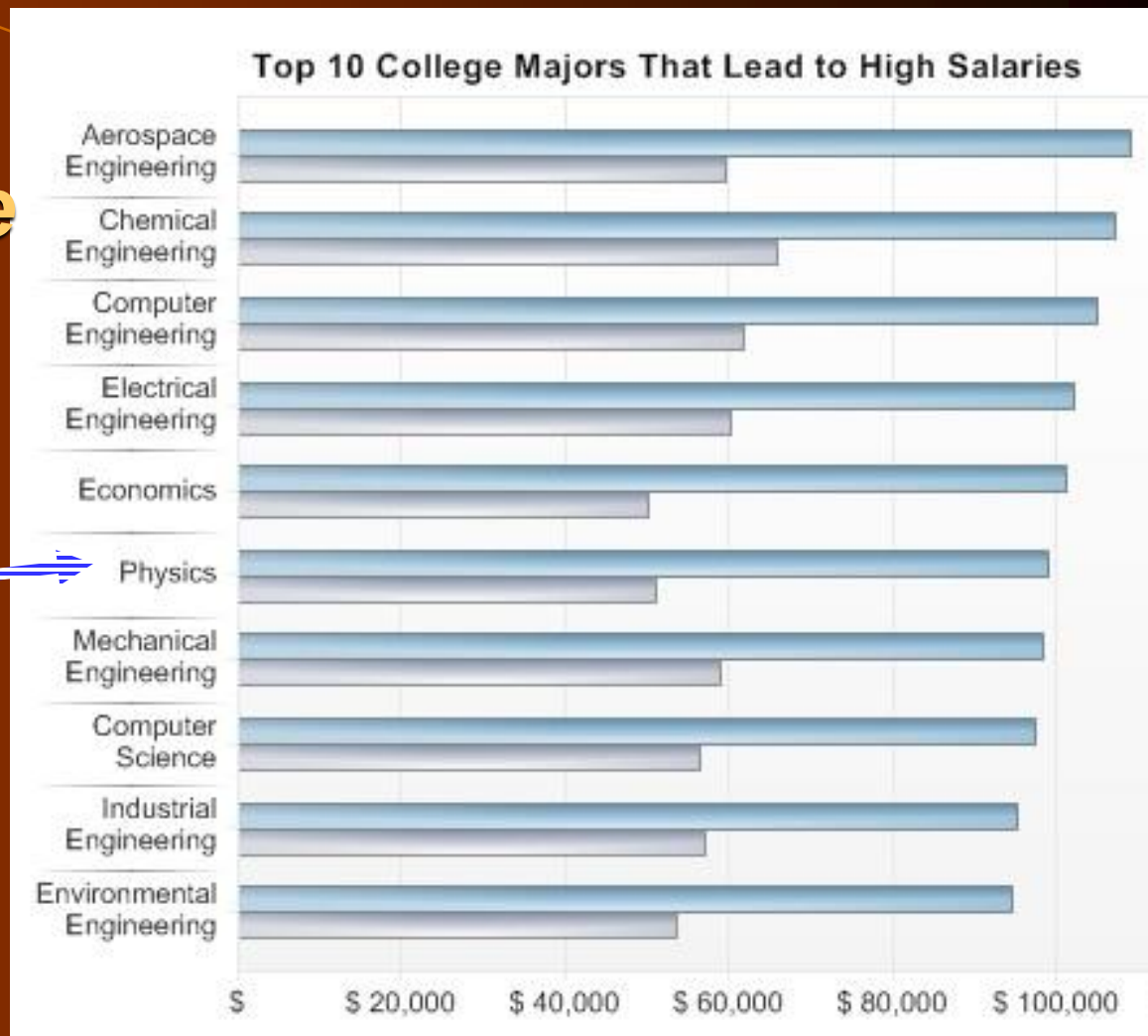
Reprinted from the Fall 2003 Salary Survey, with permission of the National Association of Colleges and Employers, copyright holder.

AMERICAN
INSTITUTE
OF PHYSICS

Statistical Research Center

www.aip.org/statistics

More up to date numbers from 2009



http://physicsworld.com/blog/2009/07/big_bucks_for_physicists.html

PHYSICS TRENDS

Contact: Raymond Y. Chu
rchu@aip.org

Winter 2004

Let's say you
get a Ph.D.
*Will that
improve your
earning
potential?*
Yup!!!

PhD Salaries 10 Years Later

Place of Employment

Hospital, medical services
Federally-Funded R & D Center
Industry or self-employed
Government
University Research Institute
University, 11-12 month
University, 9-10 month
4-year college, 9-10 month



Typical salaries are the middle 50%, i.e. between the 25th and 75th percentiles, reported by US resident members of the 10 AIP Member Societies who earned their PhDs 10 to 14 years ago.

Source: 2002 Salaries - Society Membership Survey

**AMERICAN
INSTITUTE
OF PHYSICS**

Statistical Research Center
www.aip.org/statistics

Other questions..

- *More years of school? How am I going to convince my mom to pay for that?*
 1. Believe it or not, in graduate school your tuition is paid for you
 2. Even better... you are often given a salary to take classes and do research!

Compare to Law school or Med school which can be about \$250k in loans

Switching topics...

Do physicists do anything useful or interesting?

Yes... The whole reason for doing physics is that it's the most interesting thing in the world to do!

What are the cool things physics research have produced?

- Radar
- Lasers
- The Internet
- Medical imaging (MRI)
- Optical fibers
- Power: Nuclear, Solar, Hydro, Fusion(?)
- Semiconductors (chips for computers, DVD players, video games etc...)
- Superconductors
- Lots more...

Example Differences Between Science and Engineering

- Scientists came up with the understanding of how to make the perfect wing for an airplane
- Scientists figured out how to make electronics out of materials
- Scientists figured out how to make the Internet
- Engineers worked to find which materials made it cheaper and lighter
- Engineers figured out how to put more chips on a circuit board
- Engineers figured out how to make cable cheaper so lots of people could use it ¹⁸

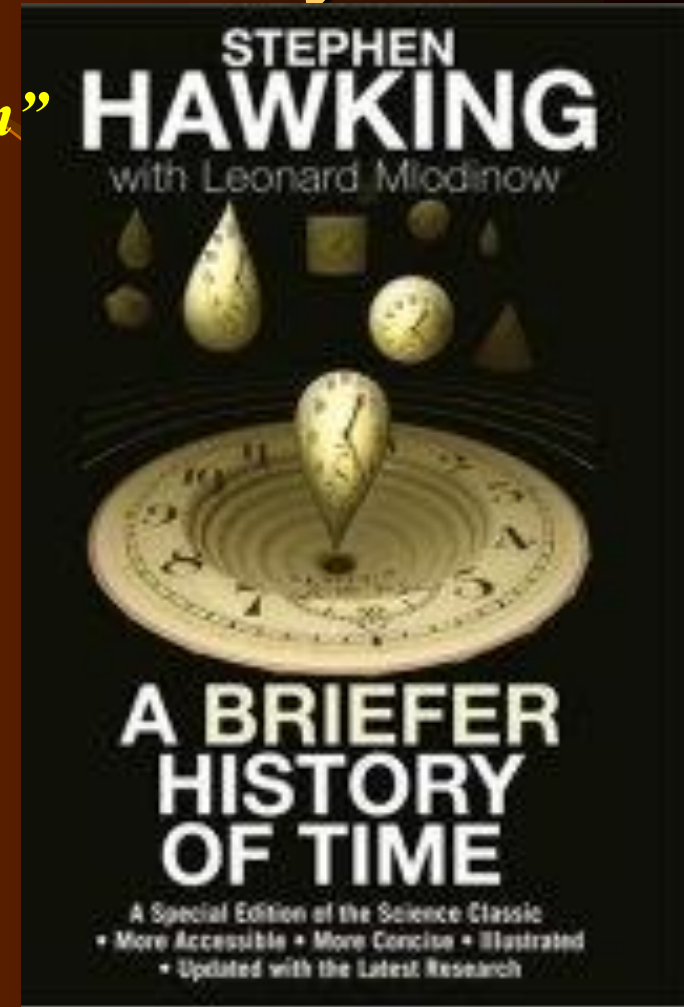
What are the interesting

- **Current Research areas: physics areas?**
 - **Astronomy, Astrophysics and Cosmology**
 - **Relativity, Origin of the Universe, Dark Energy**
 - **Condensed Matter & Materials Physics**
 - **Atomic/Laser Physics**
 - **Nuclear physics**
 - **What's inside the nucleus?**
 - **Particle physics**
 - **What's inside a proton? Dark Matter, LHC**
 - **String theory/Theory of Everything**
 - **What are particles made of?**
- **Quantum Mechanics (which is also kinda neat !)**

Interested in Learning more of the “Cool” Physics?

Physics department now offers a course entitled “*Big Bang, Black Holes, No Math*”

- Covers Stephen Hawking’s “*Brief History of Time*”
- Cross listed as ASTR/PHYS 109/119
 - Tier 2 Science Distribution Class
- Answers many of the questions you want to know about
 - Cosmology
 - Stars
 - Black Holes
 - General Relativity & Quantum Mechanics
 - Particle Physics
 - Etc....



<http://faculty.physics.tamu.edu/toback/109/>

Interested in Undergraduate Research?

Physics department has a long history of award winning undergraduate research in many areas:

- Applied Physics
- Astronomy, Astrophysics and Cosmology
- Atomic Physics
- Condensed Matter Physics
- Materials Physics
- Nuclear Physics
- Particle Physics
- Quantum Optics
- String Theory...



<http://www.physics.tamu.edu>

***Scholarships available
to the types of students
who do well on
Challenge Exams ;-)***

Keep in Touch!

**Interested in a physics degree?
Minor? Double major? Applied
physics?**

- **Pick up a Department Brochure**
- **<http://www.physics.tamu.edu/>**
- **Contact the undergraduate advisor:**
 - **Ms. Sandi Smith 979-845-7738,
smiths@tamu.edu**

**Good Luck on
your finals!**

*Extra slides on some of the
research we do here at the
Physics Department at
Texas A&M University*

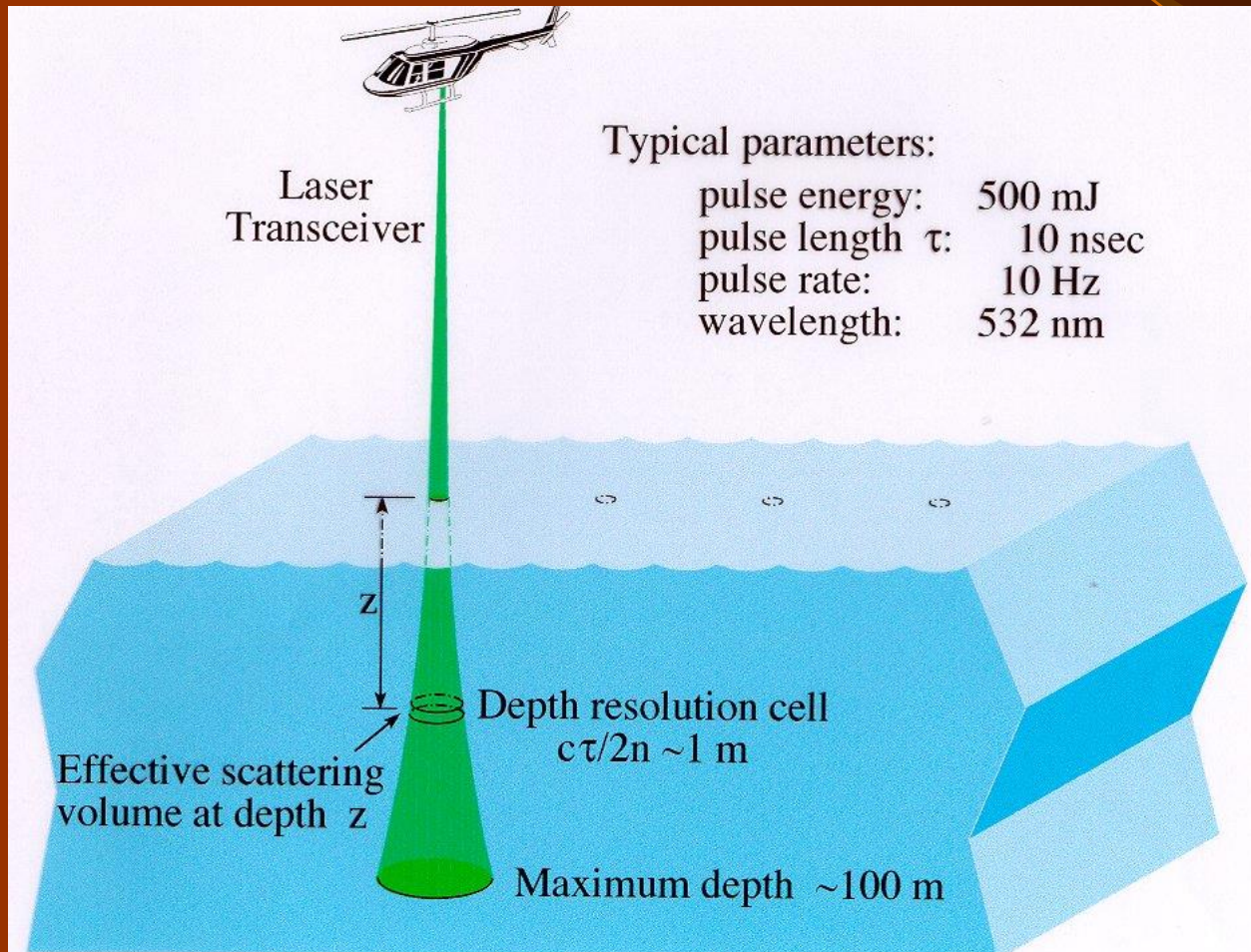
A “Theory of Everything”

String Theory,
Grand Unified
Theories, Theory
of everything...



Ocean Temperature Profile

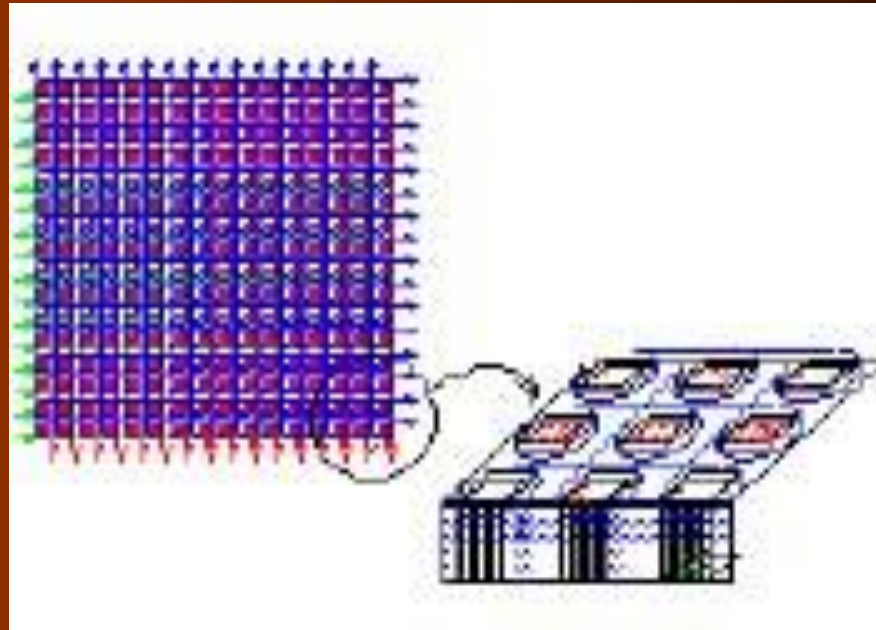
Remote Laser Sensing



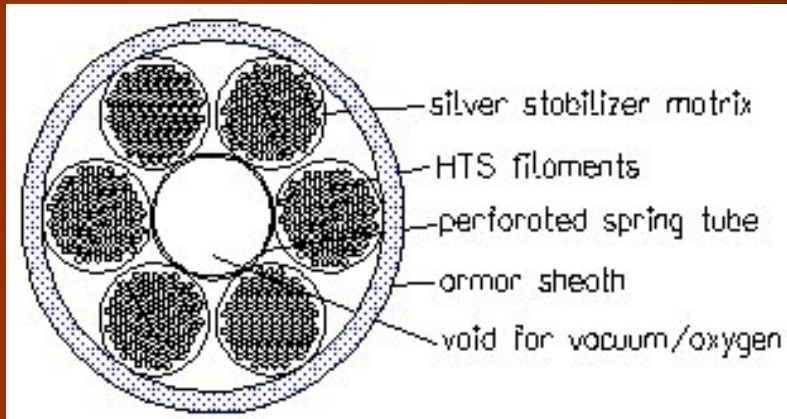
DNA Sequencing



lab-on-a-chip using
nanotechnology

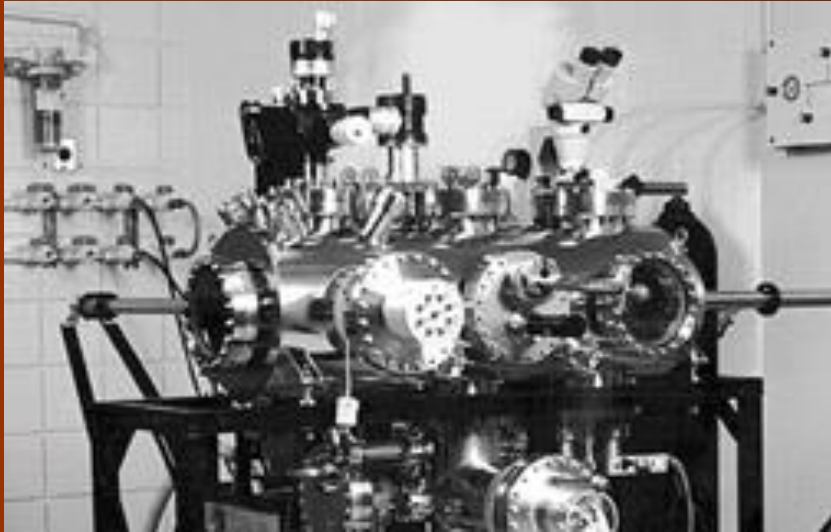


High T_c Superconductors

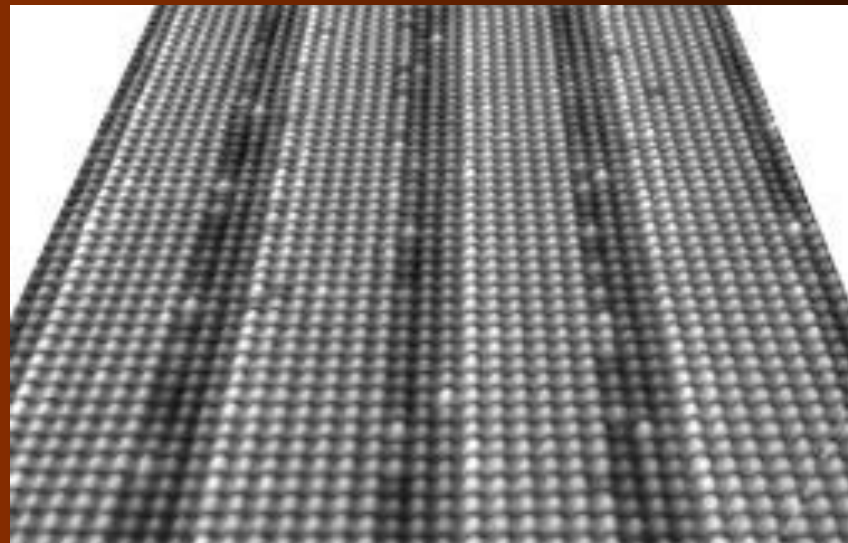


structured 1,000 A
cable for Bi-2212

Characterization at the Nanoscale



Scanning Tunneling
Microscopy e.g. an
atomically flat surface
of GaSb/InAs



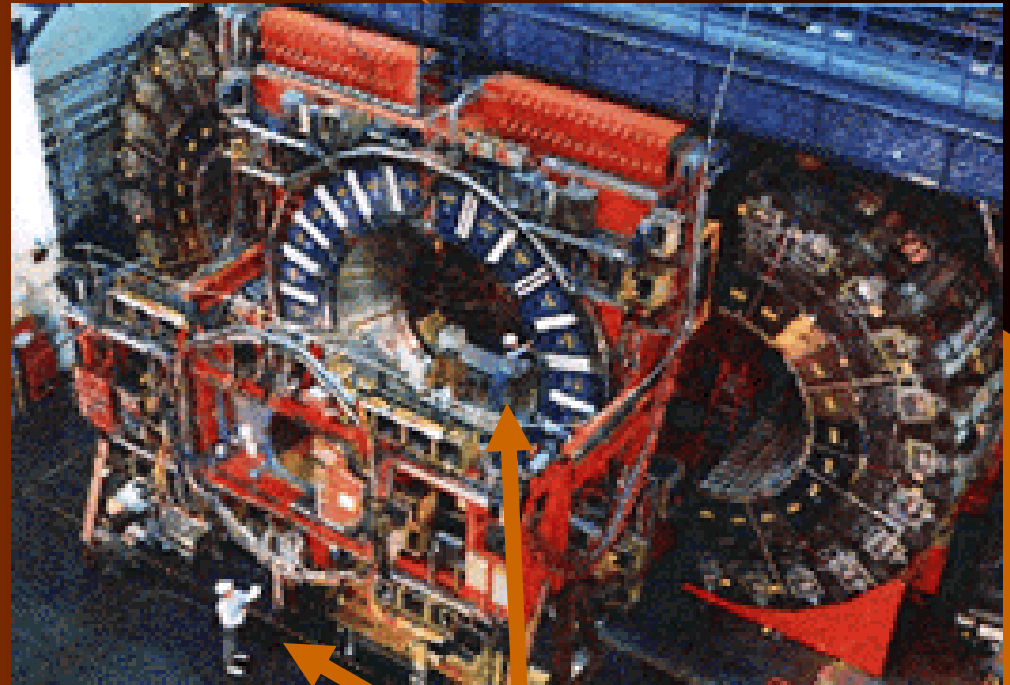
Supersymmetry Experiments



- Collider Detector at Fermilab (CDF) and CMS at the Large Hadron Collider (LHC) at CERN

- High energy frontier; Big toys

- Searching for Supersymmetry, the Higgs boson

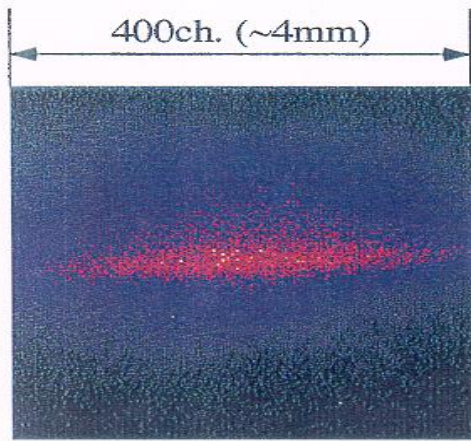


Yes that's a person!

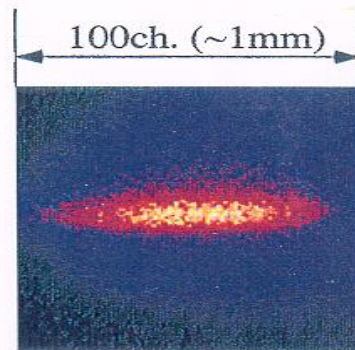
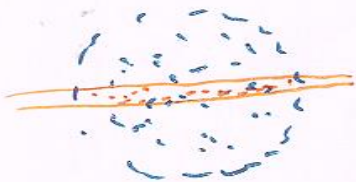
Applied Physics at Texas A&M

- Physics is crucial to many important advances
 - Computing (classical and quantum)
 - DNA sequencing and other biotech areas
 - Laser Remote Sensing
 - Magnetic Devices and Data Storage
 - Nanotechnology and Sensing
 - Optical Technology
 - Superconductivity (low T_c and high T_c)

Fluorescence from laser cooled ions



a) Ion cloud condition soon after trapping



b) Cooled ion cloud



c) Four ion crystal



d) Three ion crystal



e) Single cooled ion

Space charge distributions in a linear RF ion trap (storage time ~40 sec)

The Cyclotron

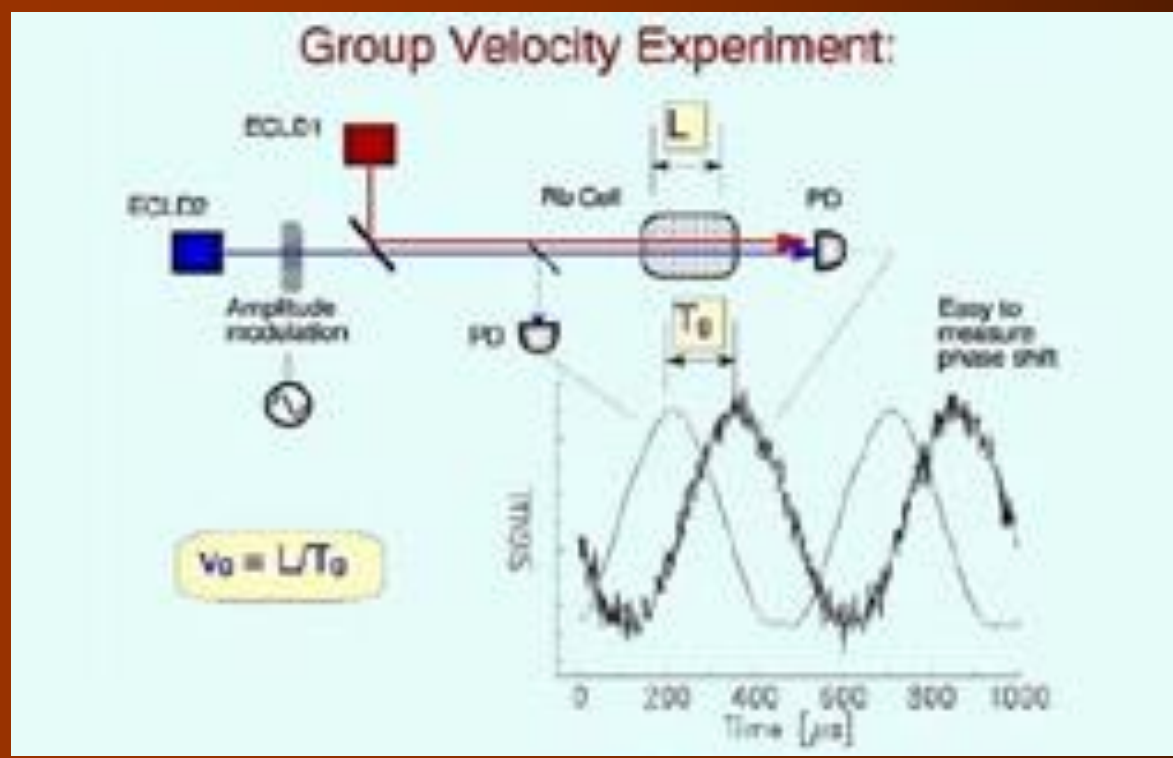


One of two
University based
Cyclotrons in
the US



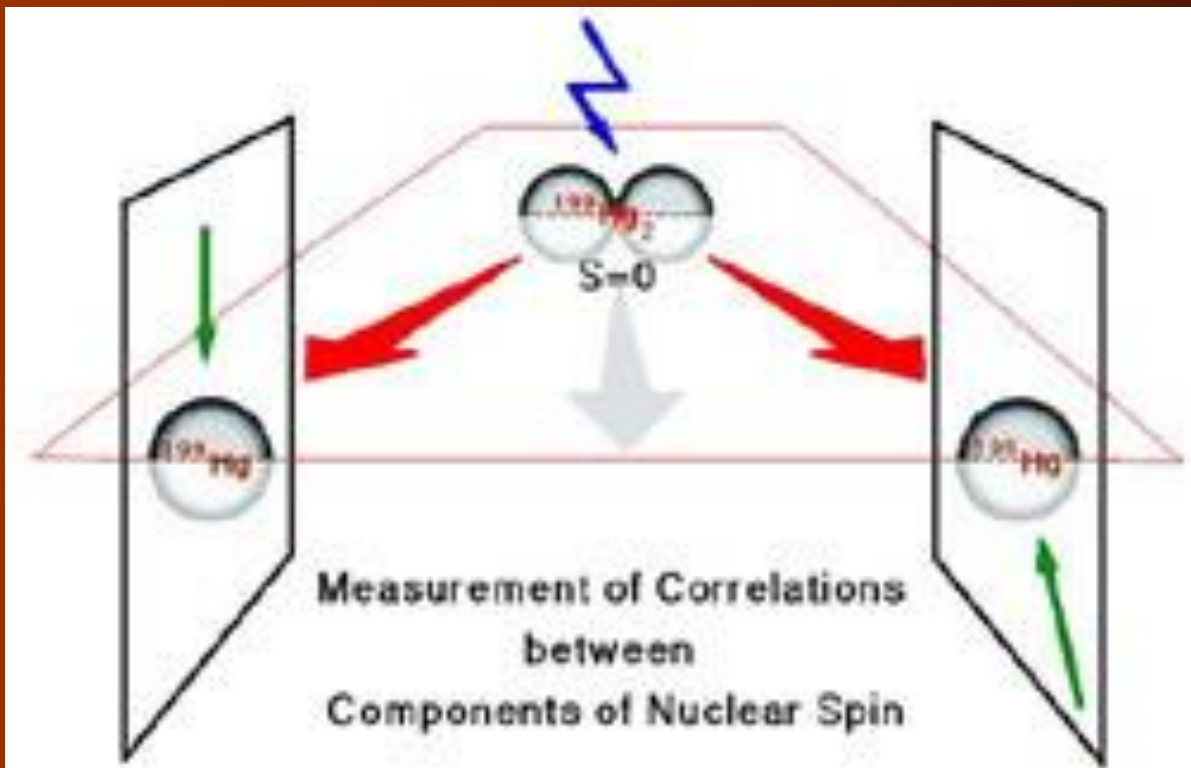
“Slow Light”

Welch: Group Velocity of Light can be reduced



Quantum Mechanical Foundations

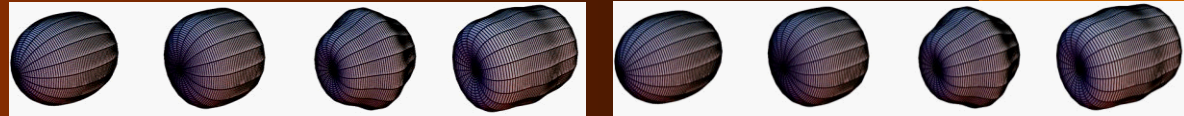
Fry, Walther: Einstein-Podolsky-Rosen
Experiment based on atoms



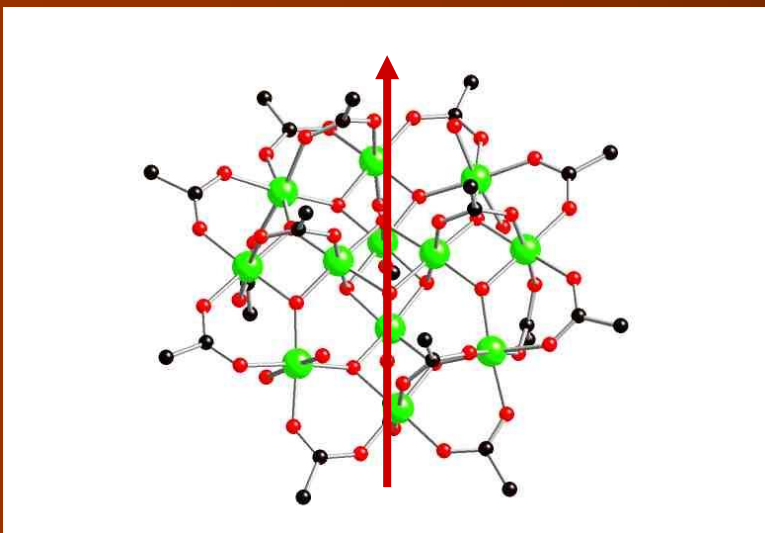
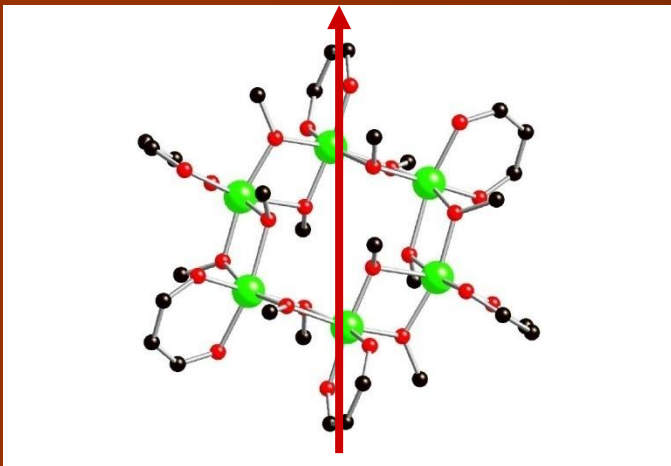
Collinear Raman Generator



- A new light source to study new physics
- Extension of EIT ideas to molecular systems
- Photoionization with single-cycle pulses.
- Possible extensions of our technique:
 1. studying complicated motion of complex molecules
 2. probing ultrafast electronic dynamics in atoms.



Devices based on Molecular Nanomagnets



Large Magnetic Moment

Potentially useful for:

- Magnetic storage
- Quantum Computing

Nanomagnetic Sensing

Teizer: Micro-
and NanoSQUIDs

