

# Mechanics Scholars Luncheon

Texas A&M University



## *Opportunities for* *Talented People with* *Physics Training*

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# 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*

- *All physics majors are dorks and kinda weird*
- *I don't know ANYONE who does physics except my high school teacher and my Prof from this last semester*

## 2. *Job:*

- *If you have a physics degree, you can either be a professor or a high-school teacher. Right?*
- *The only thing you can do with a physics degree is research in physics. Right?*
- *There are no jobs for people with a physics degree*

# Common Myths cont...

## More common myths

### 3. *Money:*

- *The salaries for people with physics degrees aren't good*

### 4. *Uhhh... Is it any fun?*

- *What do professors 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*
- *What are the research areas?*

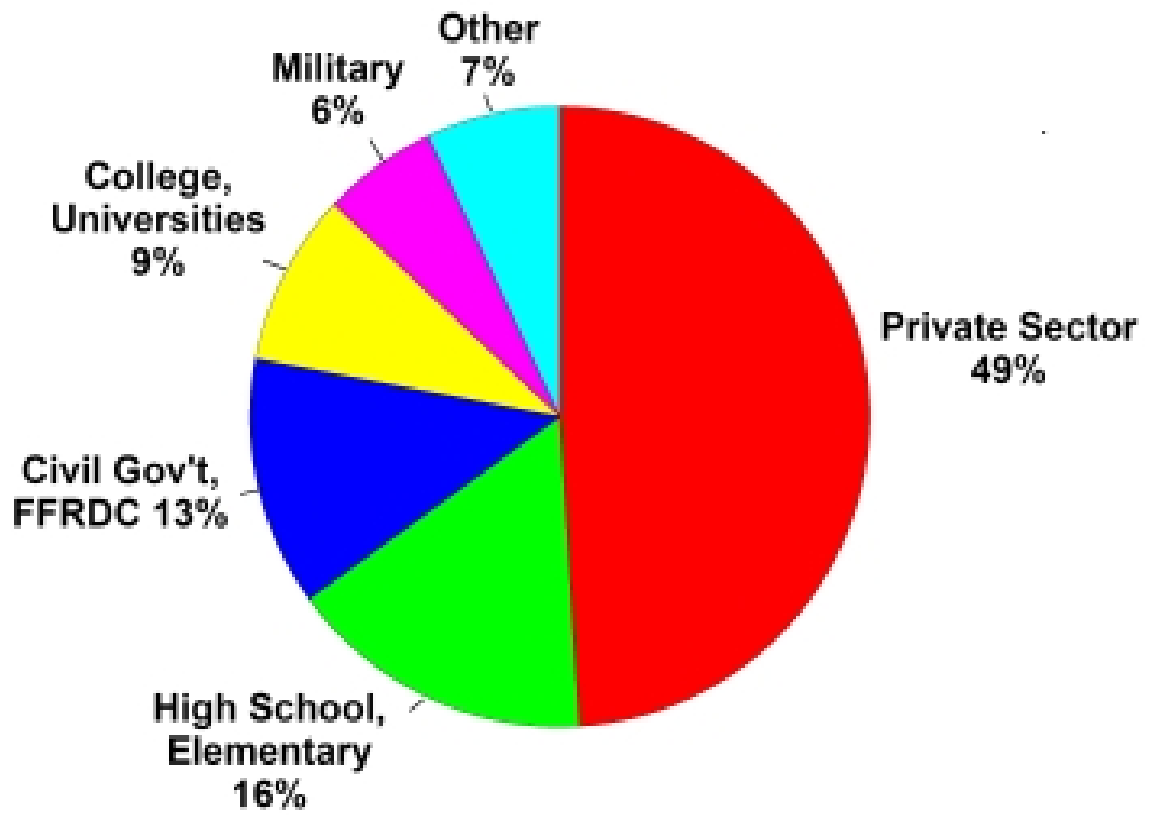
**Warning: My answers may be more blunt than you wanted...**

Let's talk *Jobs* and *Money* first since, frankly, I think that is what most of you would need to hear about anyway before we get to any of the other stuff...

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

# High School Teacher or a Professor only? No!

Employer Distribution for Full-time US employed Physics Bachelors, classes of 2001 and 2002



*Whoever told you that had no clue!*

# No jobs?

- Let's get this straight...the unemployment rate for people with physics degrees is historically below 2% which is well below the national average

**Ok... what kind  
of job?**

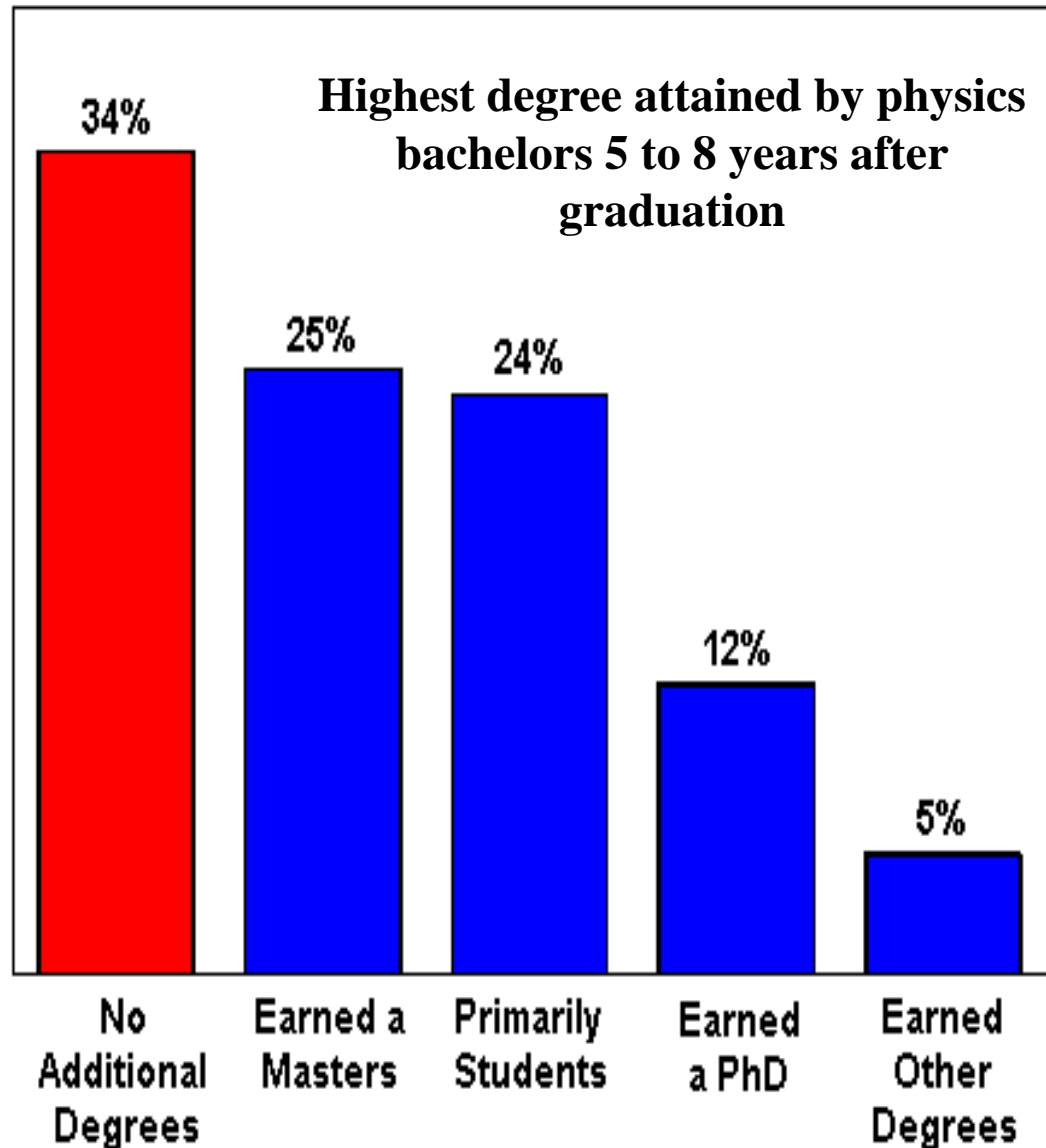
**Depends on what kind of  
degree you get... let's do them  
one at a time:**

- 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



Ok... What do they do with their bachelors degree?

Table 7. Primary work activity for physics bachelors, classes of 2001 & 2002.

| Activities related to:   | Employment Sector   |                       |                            |
|--|---------------------|-----------------------|----------------------------|
|  | Private Sector<br>% | Civil Government<br>% | Colleges & University<br>% |
| Computer programming, system administration, simulation and modeling | 28                  | 34                    | 17                         |
| Design and development   | 23                  | 17                    | 6                          |
| Service related activities <sup>(1)</sup>                            | 19                  | 3                     | 4                          |
| Manufacturing <sup>(2)</sup>   | 13                  | 6                     | 3                          |
| Research   | 8                   | 33                    | 41                         |
| Management & Administration  | 5                   | 3                     | 10                         |
| Education  | 1                   | 2                     | 15                         |
| Other  | 3                   | 2                     | 4                          |

Activities include: (1)Legal, financial, medical, writing (2) production, operations, construction, quality control

*AIP Statistical Research Center, Initial Employment Report.*

# 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

### **Compaq Computer**

Control Systems International

Cypress Semiconductor

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 things I might do?**

**A: Yup!!!**

# PHYSICS TRENDS

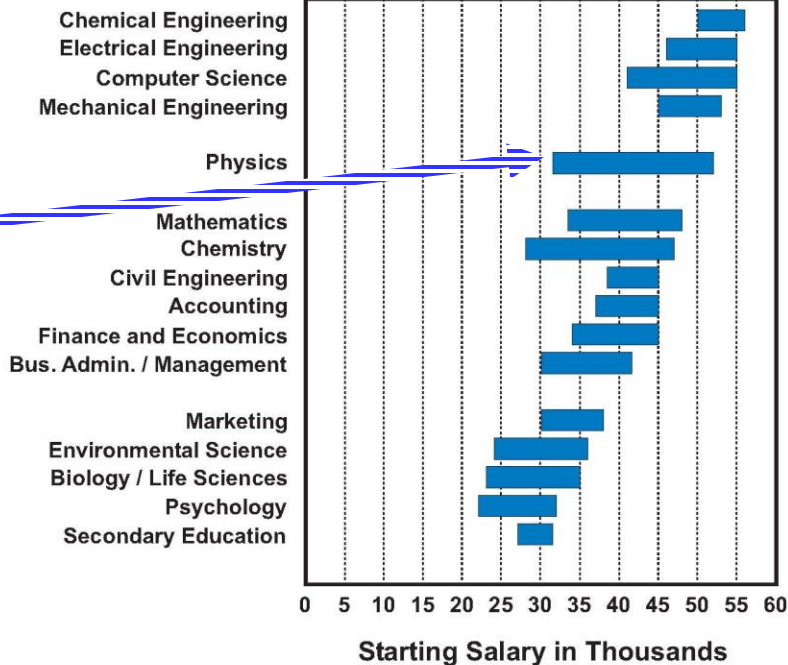
Contact: Patrick J. Mulvey  
pmulvey@aip.org

Fall 2003

## What's a Bachelor's Degree Worth?

Typical Salaries Offered by Campus Recruiters, 2002-2003

### Bachelor's Field



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.

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**Statistical Research Center**  
[www.aip.org/statistics](http://www.aip.org/statistics)

**What about  
a couple of  
years down  
the road?  
What will I  
be doing  
then?**

**Table 1. Type of Employment of Physics Bachelors  
5 to 8 Years After Graduation**

| Type of Job                     | Percent |
|---------------------------------|---------|
| Software                        | 24      |
| Engineering                     | 19      |
| Science & Lab Technician        | 9       |
|                                 |         |
| Management, Owner & Finance     | 20      |
| Education                       | 12      |
| Active Military                 | 6       |
| Service and Other Non-Technical | 10      |

Based on physics bachelors with no additional degrees who are not primarily students.

AIP Statistical Research Center, 1998-99 Bachelors Plus Five Study.

# PHYSICS TRENDS

Contact: Raymond Y. Chu  
rchu@aip.org

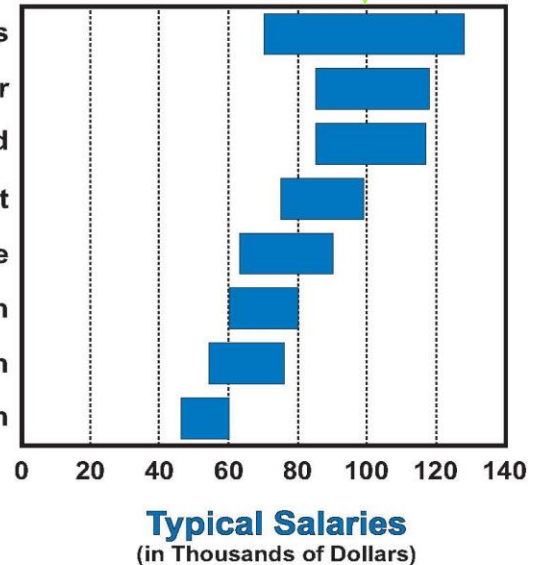
Winter 2004

Let's say you  
get a Ph.D.  
Will that  
improve your  
earning  
potential?  
**Yup!!!**  
You can do  
physics or  
applied  
physics

## 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

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Statistical Research Center  
[www.aip.org/statistics](http://www.aip.org/statistics)

If I get a PhD  
what kind of  
money will I  
end up  
making long  
term?  
**VERY Good  
money  
whether you  
stay in the  
field or not!**

Typical salaries and median age for major employment sectors, PhDs  
2004. (a)

| Academic Sector                  | Typical Salaries   | Median Age |
|----------------------------------|--------------------|------------|
| University 9-10 Month Salary     | \$60,000 - 96,000  | 48         |
| University 11-12 Month Salary    | \$59,000 - 110,000 | 48         |
| 4 Year College 9-10 Month Salary | \$49,000 - 68,000  | 46         |
|                                  |                    |            |
| Non-Academic Sector              | Typical Salaries   | Median Age |
| Hospital, medical services       | \$92,000 - 150,000 | 48         |
| FFR&DC (b)                       | \$96,000 - 130,000 | 49         |
| Industry, self-employed          | \$85,000 - 127,000 | 47         |
| Government                       | \$86,000 - 125,000 | 51         |
| Nonprofit                        | \$67,000 - 108,000 | 47         |
| UARI (b)                         | \$60,000 - 100,000 | 46         |

(a) Employed U.S. resident members only. Postdoctorates not included.  
(b) FFR&DC= Federally-Funded Research and Development Center  
UARI= University-Affiliated Research Institute or Observatory.

# 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 PAID a salary to take classes and do research!

Compare to law-school which is about \$200k 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?

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

# What are the interesting physics areas?

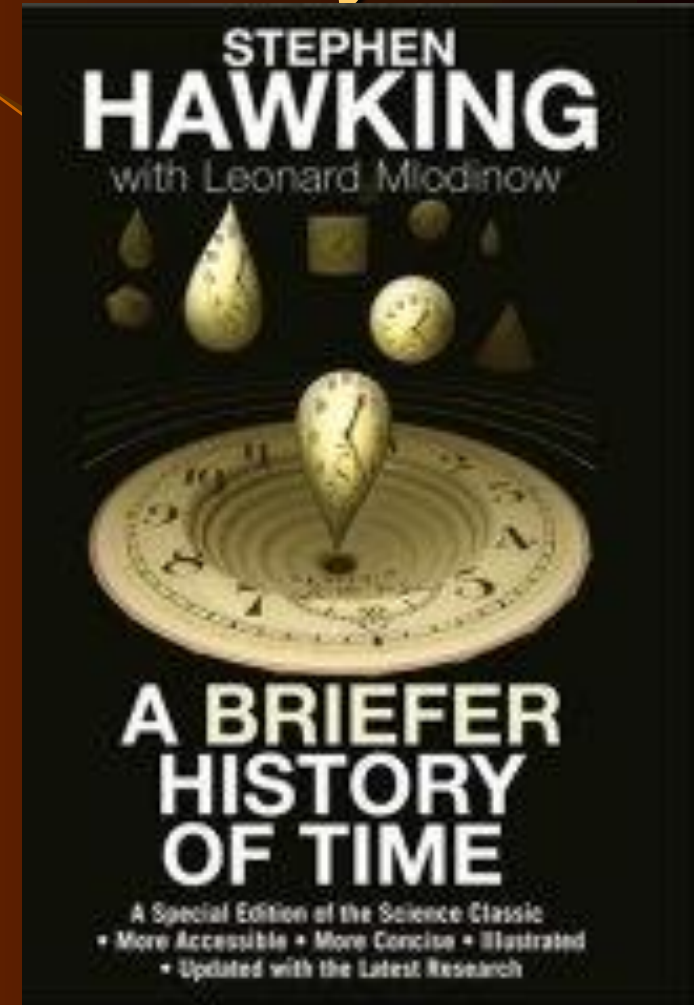
- **Current Research areas:**

- **Astronomy, Astrophysics and Cosmology (relativity and the study of the 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?)**
- **String theory/Theory of Everything (what are particles made of?)**
  - **All of these use 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*”
- Physics 289
- Answers many of the questions you want to know about
  - Quantum Mechanics
  - General Relativity
  - Particle Physics
  - Black Holes
  - Etc....



<http://faculty.physics.tamu.edu/toback/289/>

# 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*



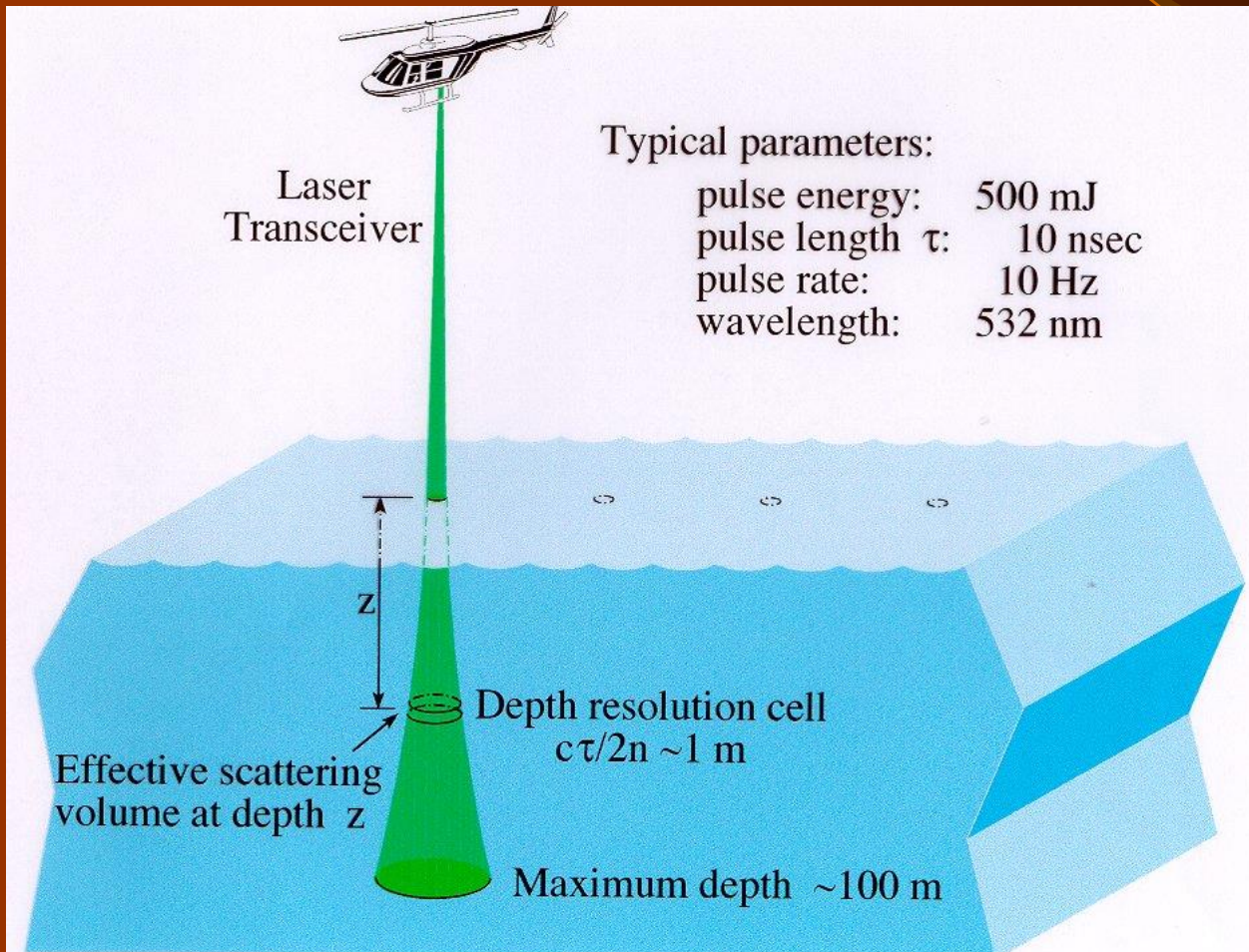
# A “Theory of Everything”

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



# Ocean Temperature Profile

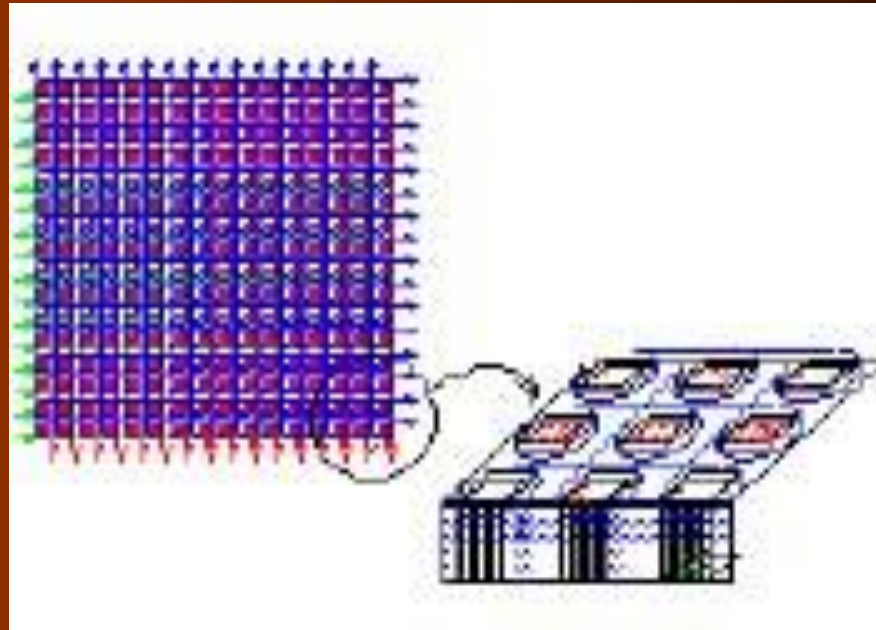
## Remote Laser Sensing



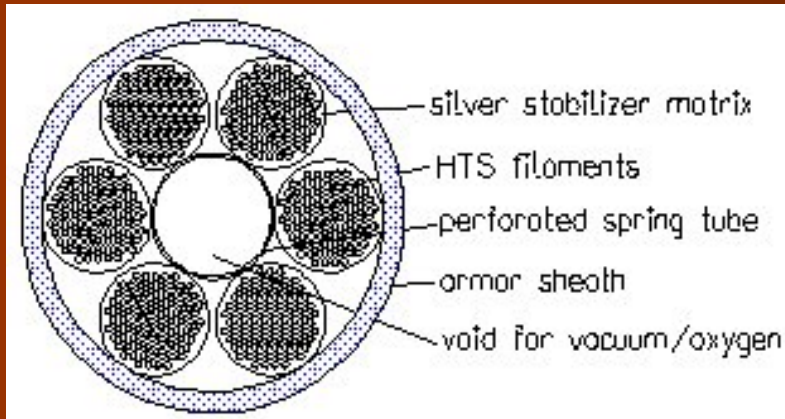
# DNA Sequencing



lab-on-a-chip using  
nanotechnology

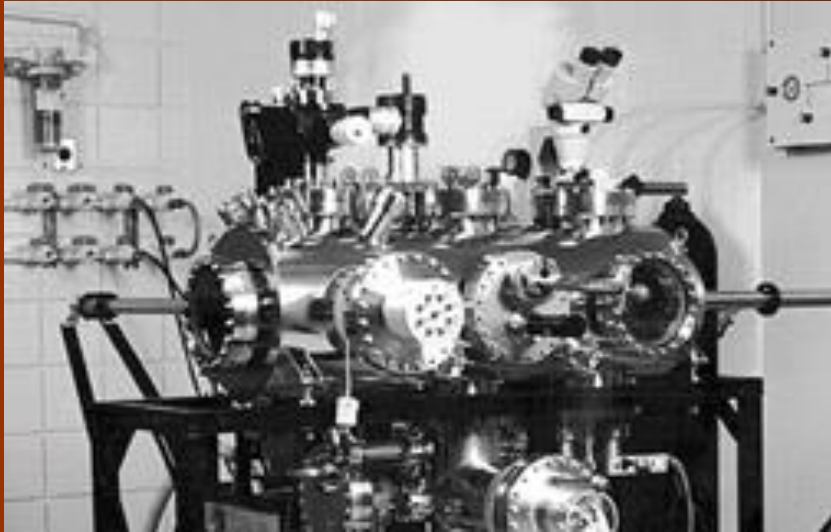


# High $T_c$ Superconductors

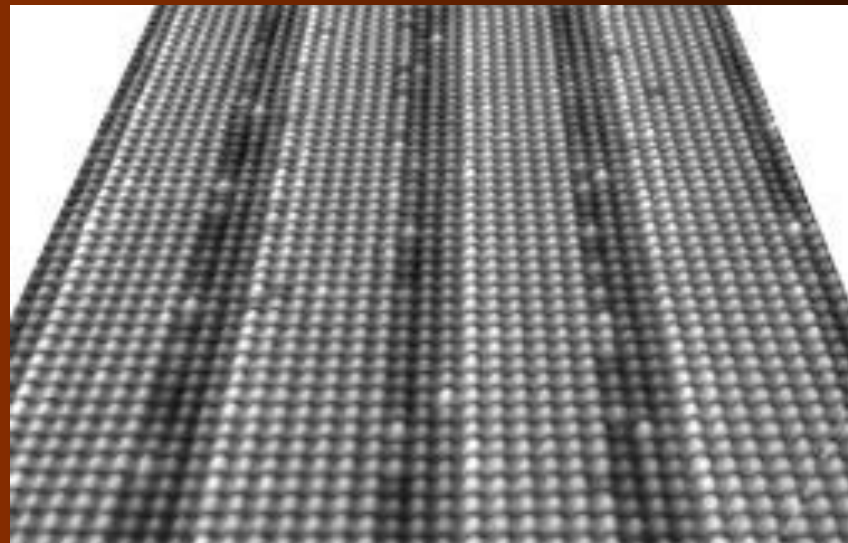


structured 1,000 A  
cable for Bi-2212

# Characterization at the Nanoscale



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



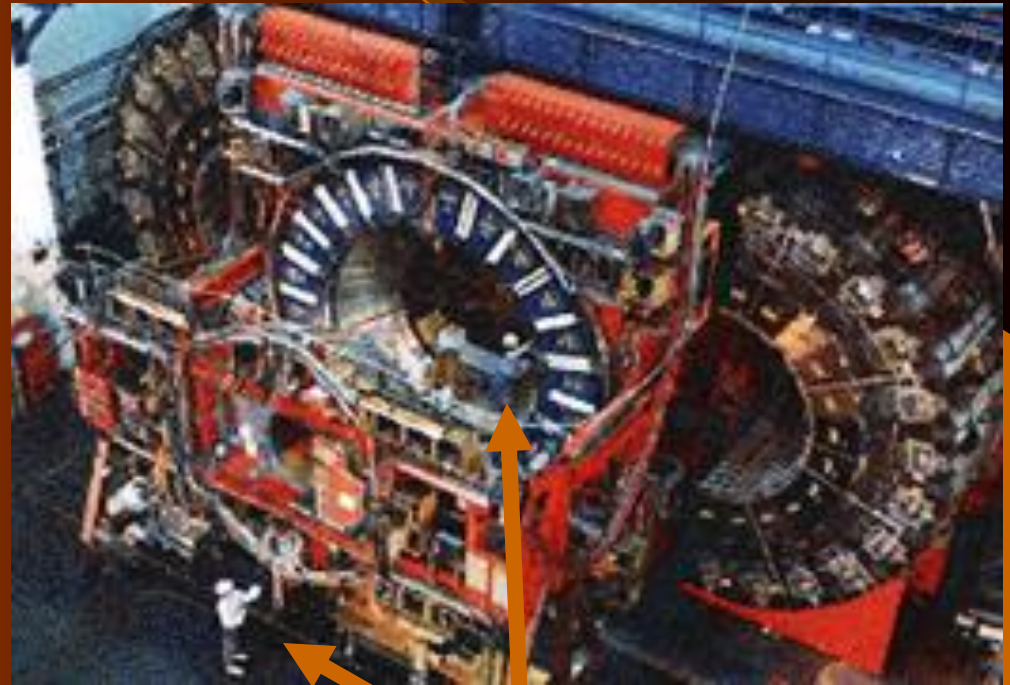
# Supersymmetry Experiments



- 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

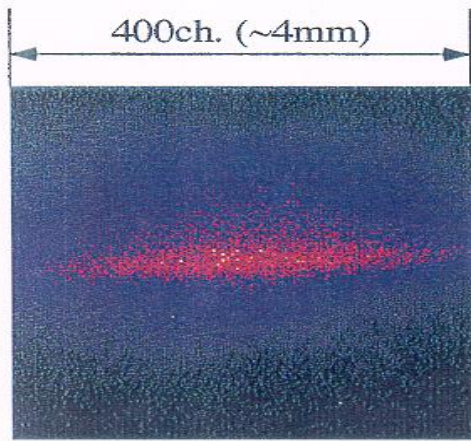


Yes that's a person!

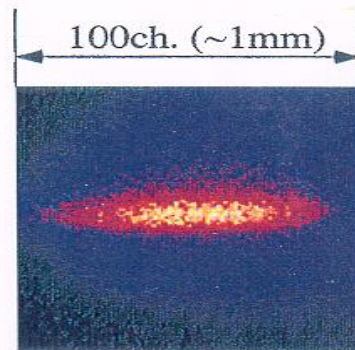
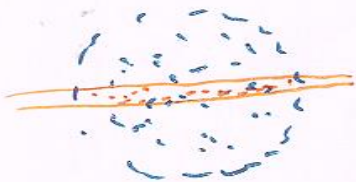
# Applied Physics at Texas A&M

- 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  $T_c$ )

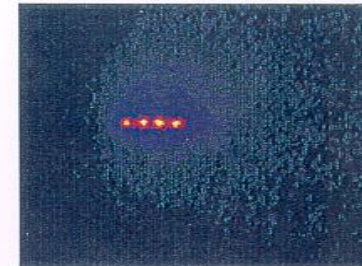
# Fluorescence from laser cooled ions



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

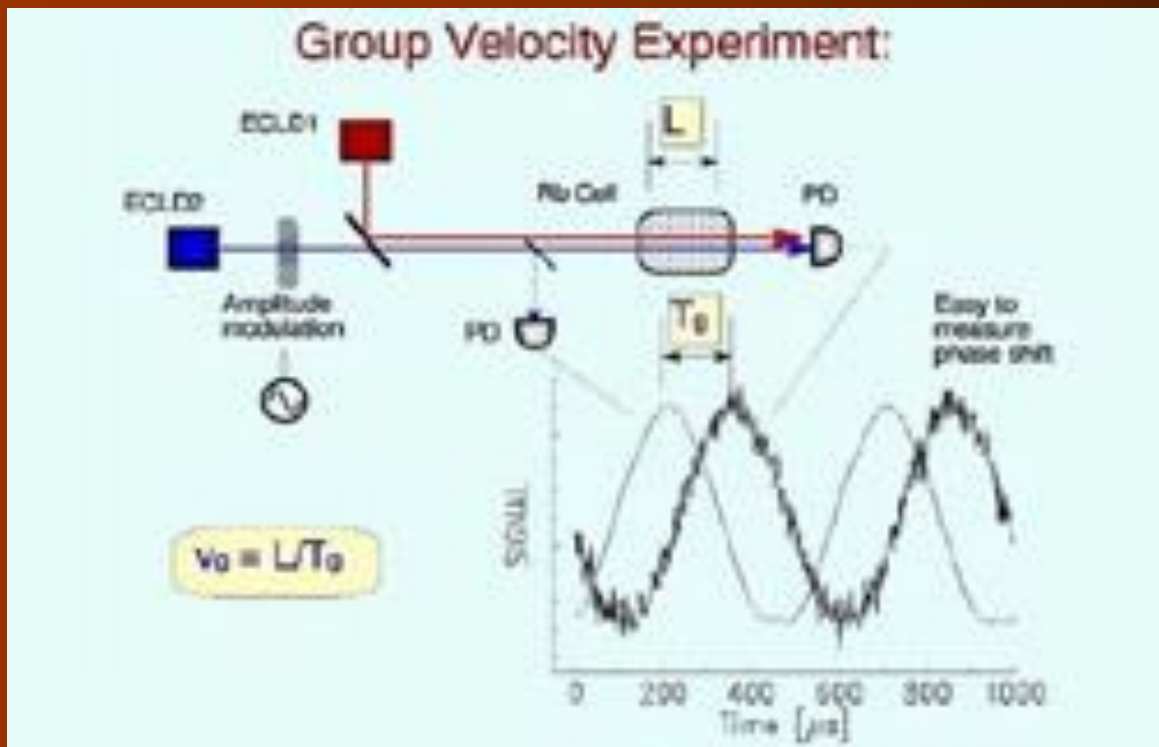


One of two  
University based  
Cyclotrons in  
the US



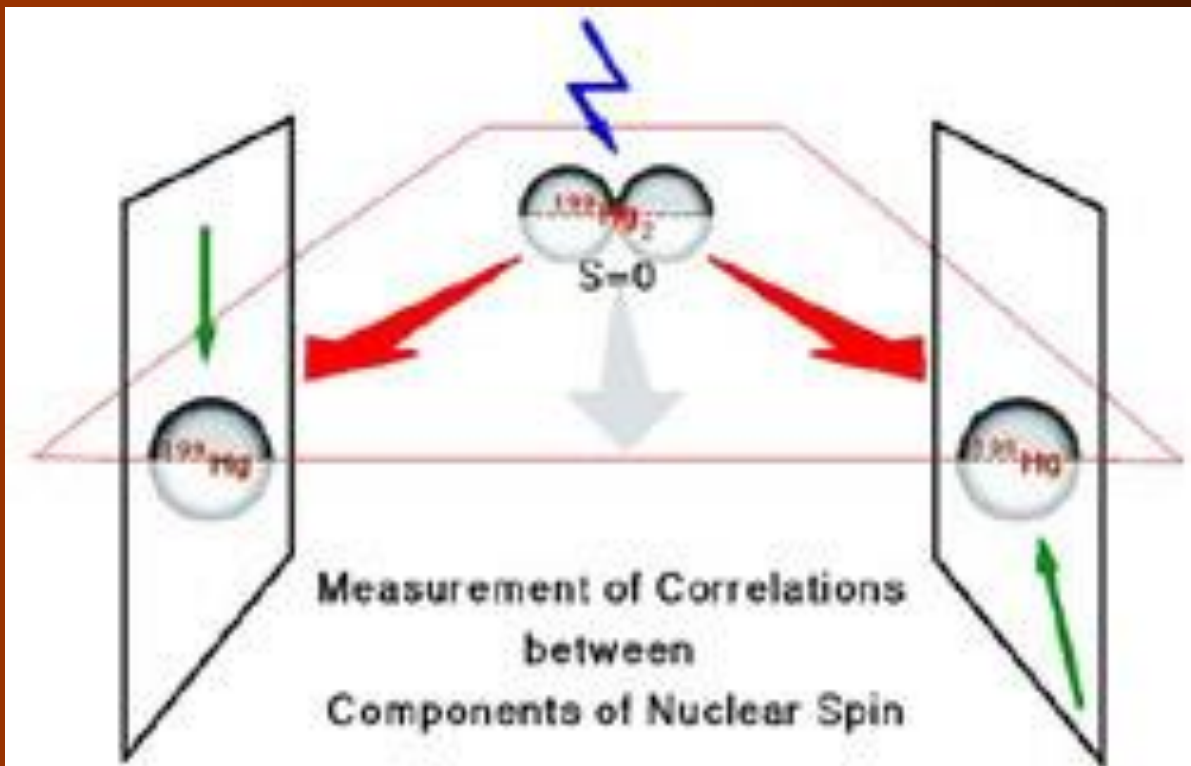
# “Slow Light”

Welch: Group Velocity of Light can be reduced



# Quantum Mechanical Foundations

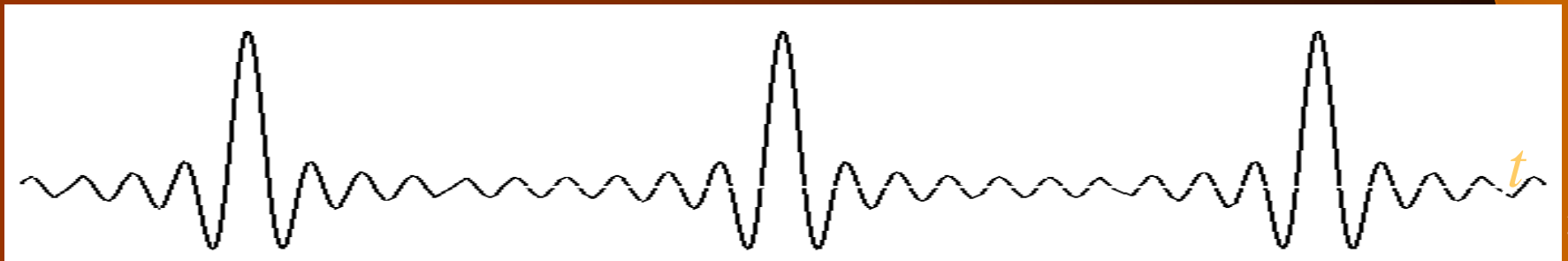
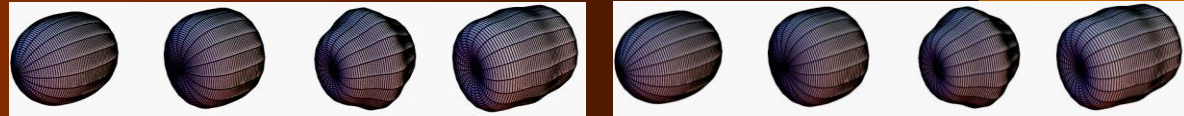
Fry, Walther: Einstein-Podolsky-Rosen  
Experiment based on atoms



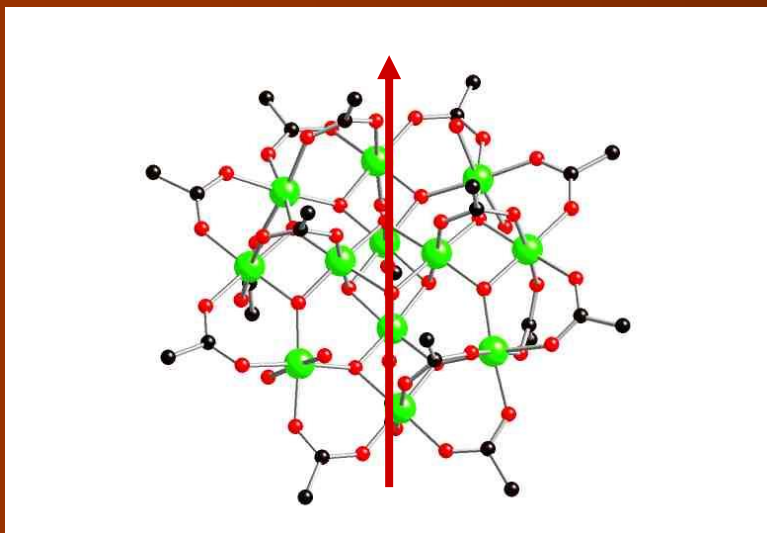
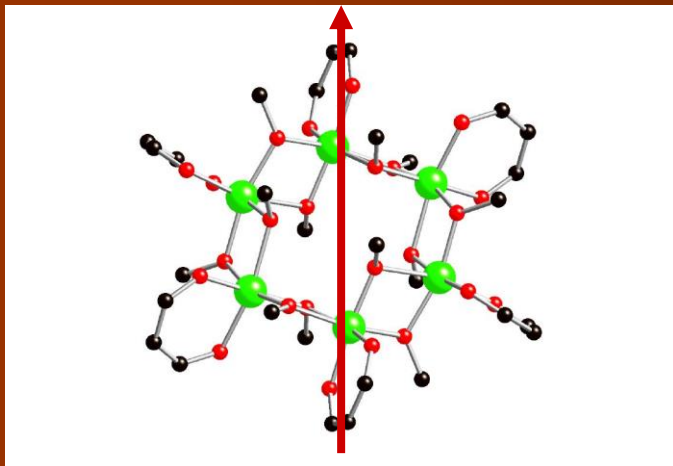
# Collinear Raman Generator



- 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

