

Mechanics Scholars Luncheon

Texas A&M University



Opportunities for Talented People with Physics Training

David Toback

Department of Physics

Texas A&M University

Phone: 979-845-1179

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*

- *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?*

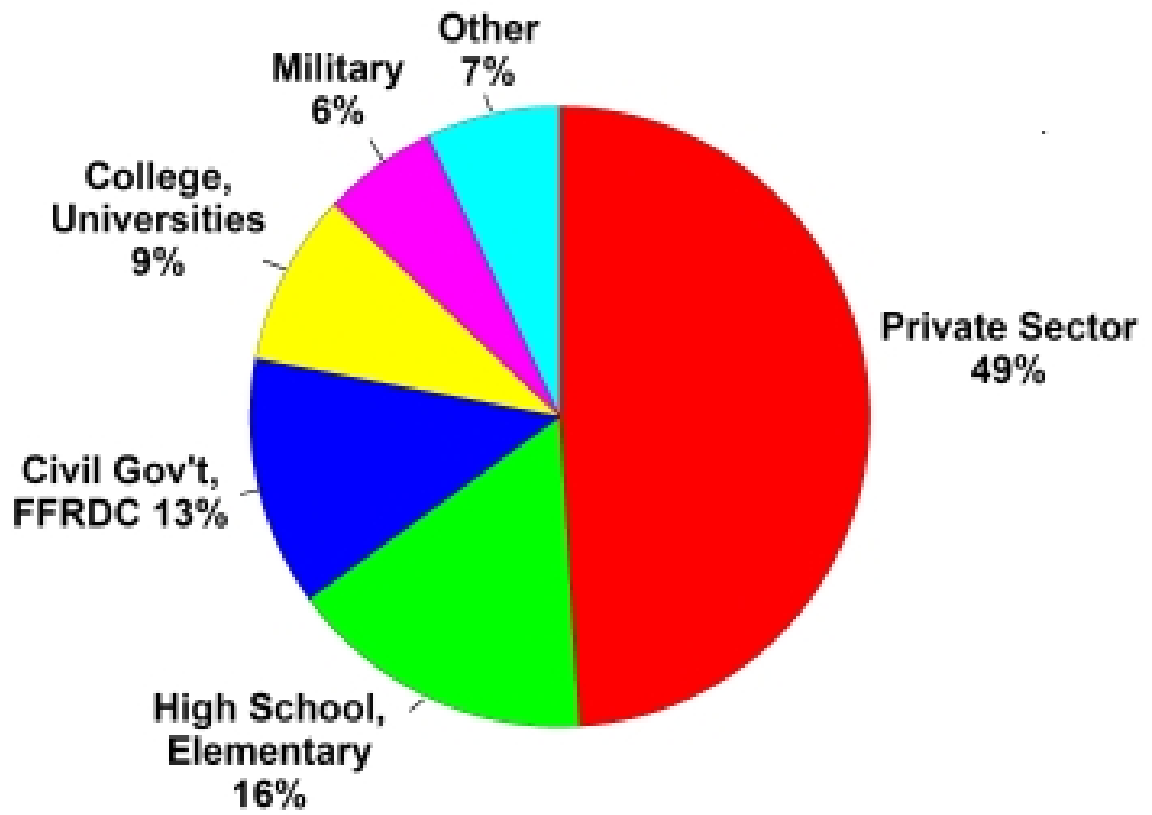
Warning: My answers may be more blunt than you wanted...

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

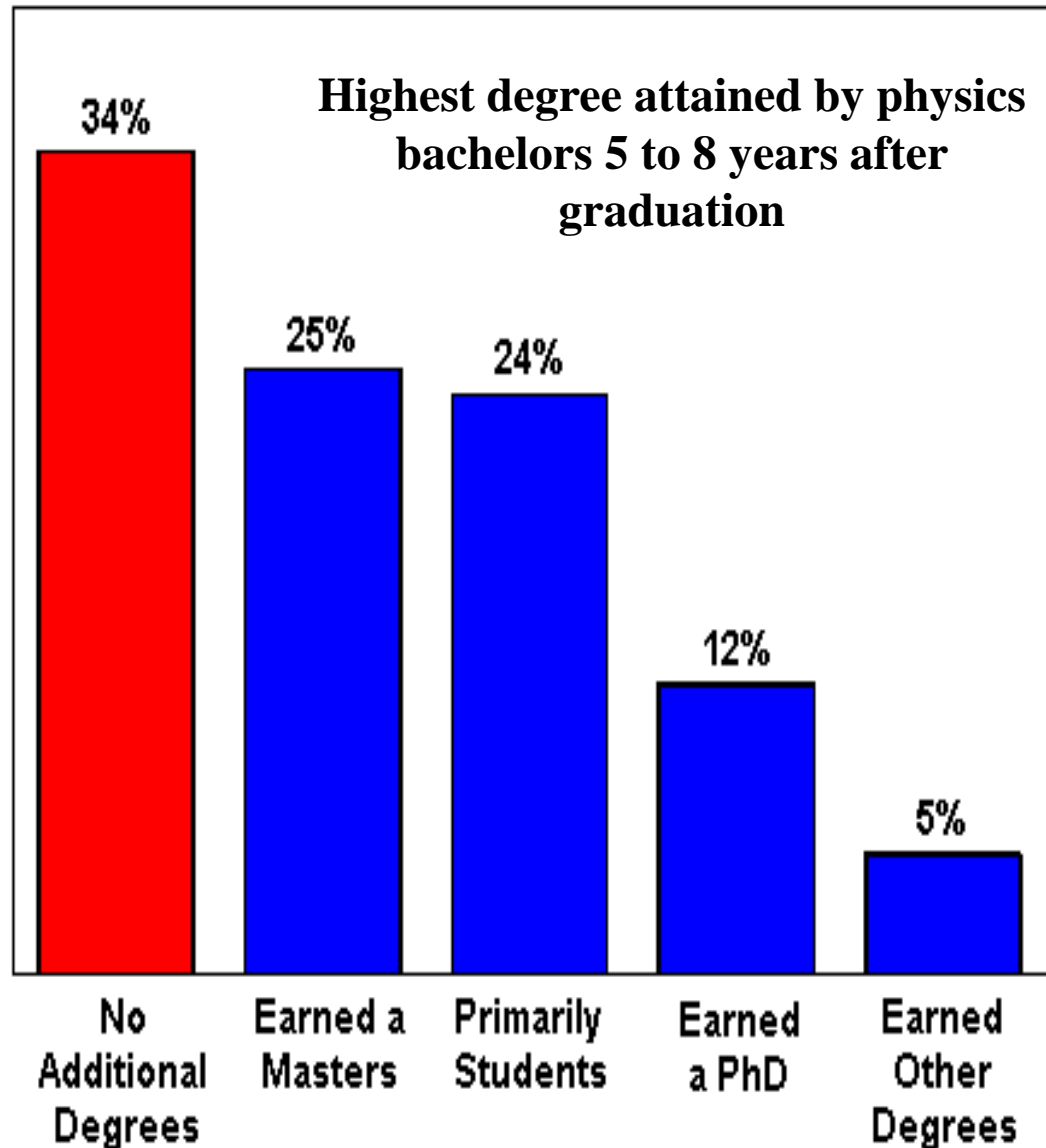
**Ok... what kind
of job?**

**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 %	Civil Government %	Colleges & University %
Computer programming, system administration, simulation and modeling	28	34	17
Design and development	23	17	6
Service related activities ⁽¹⁾	19	3	4
Manufacturing ⁽²⁾	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!!!

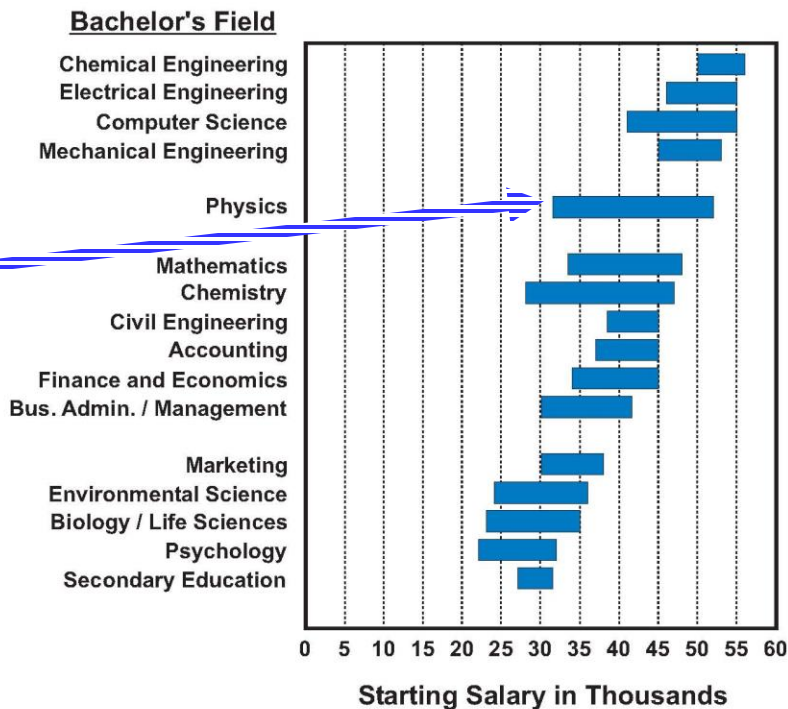
PHYSICS TRENDS

Contact: Patrick J. Mulvey
pmulvey@aip.org

Fall 2003

What's a Bachelor's Degree Worth?

Typical Salaries Offered by Campus Recruiters, 2002-2003



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

**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

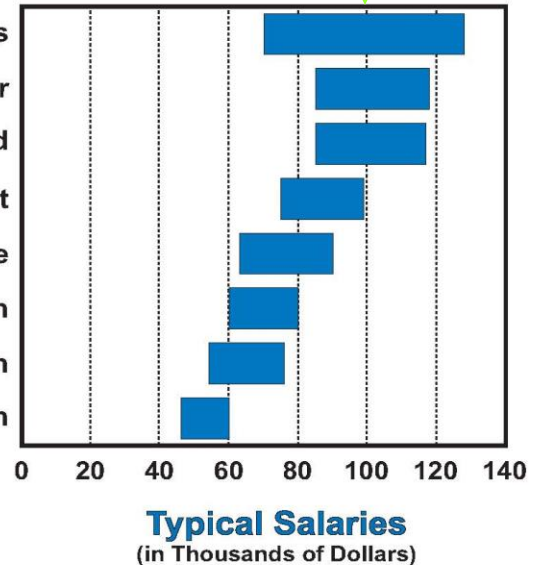
Winter 2004

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

AMERICAN
INSTITUTE
OF PHYSICS

Statistical Research Center
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?

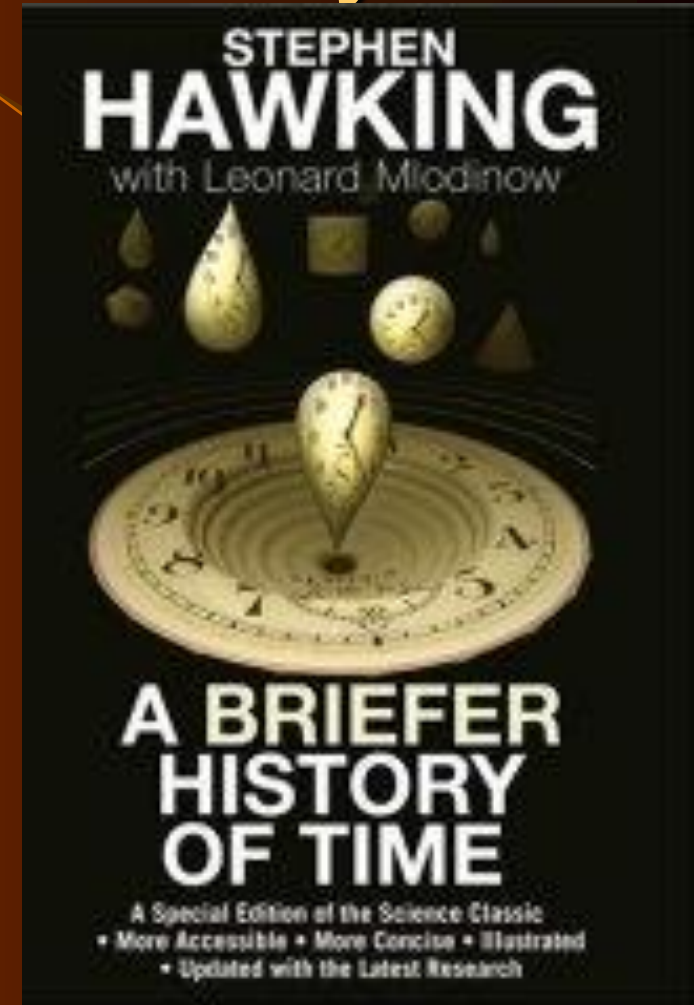
- **Current Research areas:**

- **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*

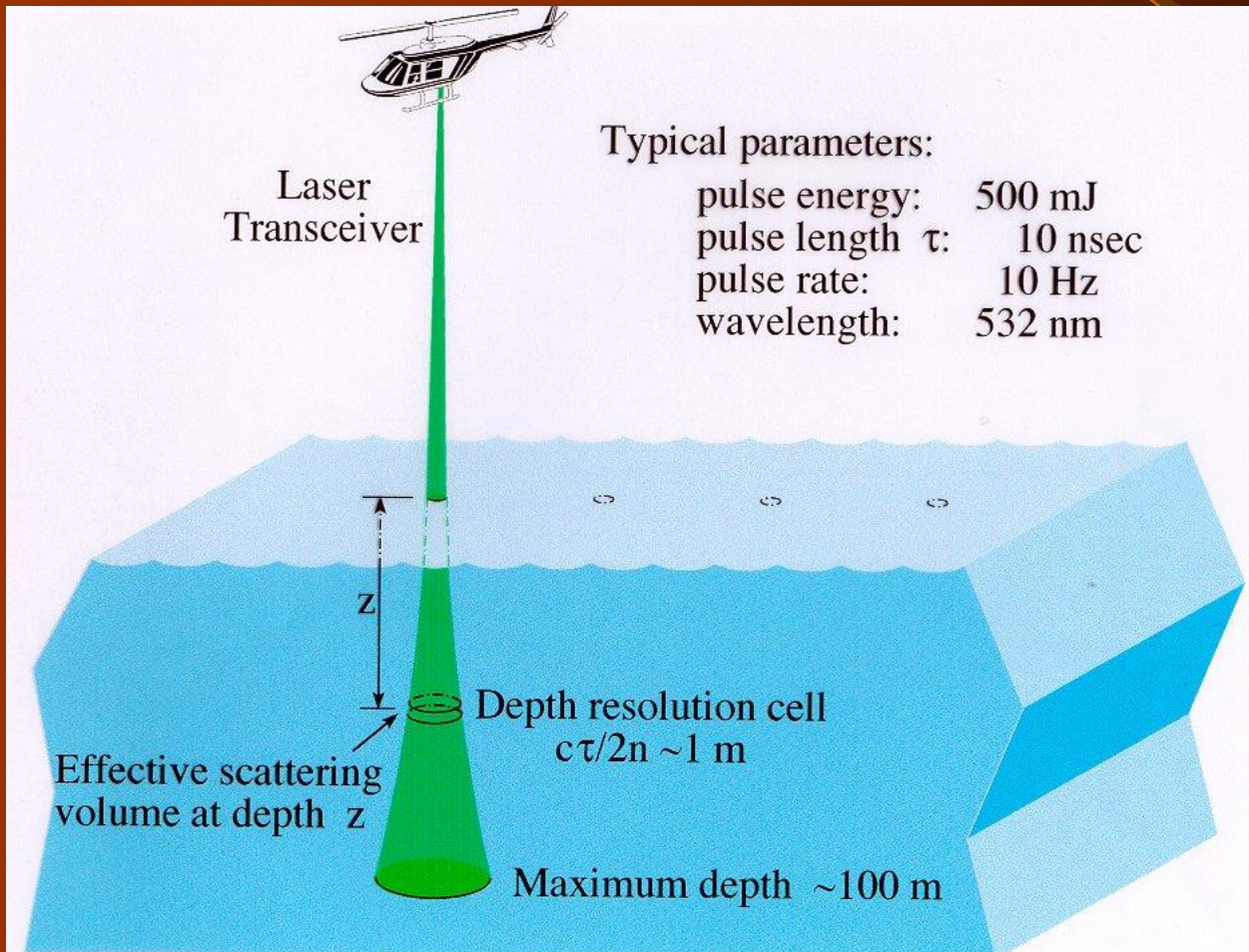
A “Theory of Everything”

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



Ocean Temperature Profile

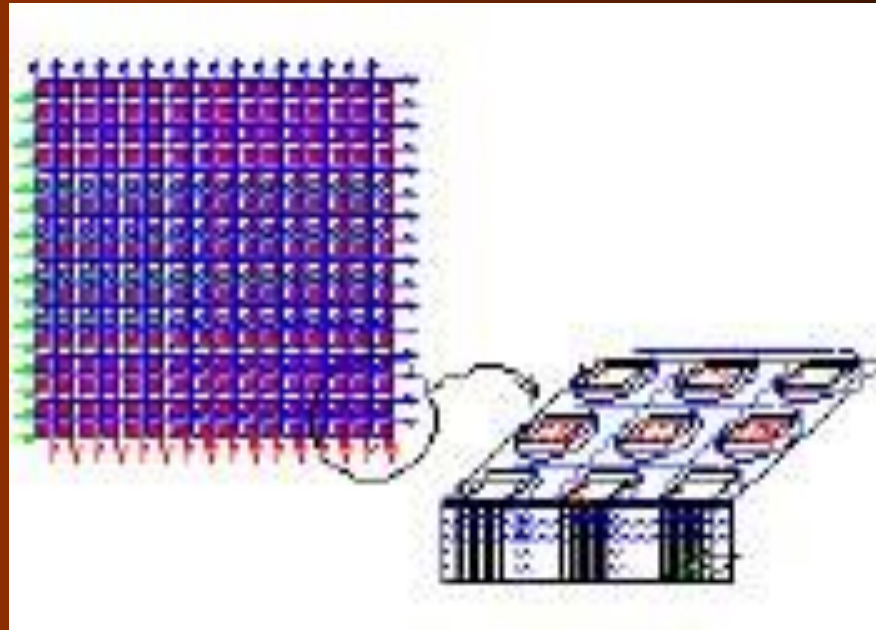
Remote Laser Sensing



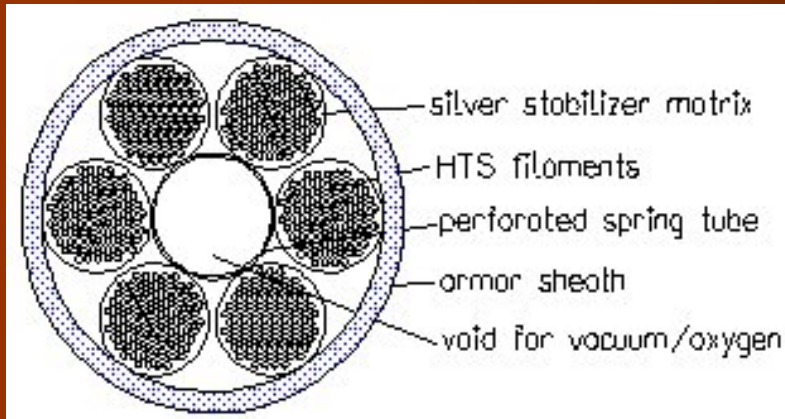
DNA Sequencing



lab-on-a-chip using
nanotechnology

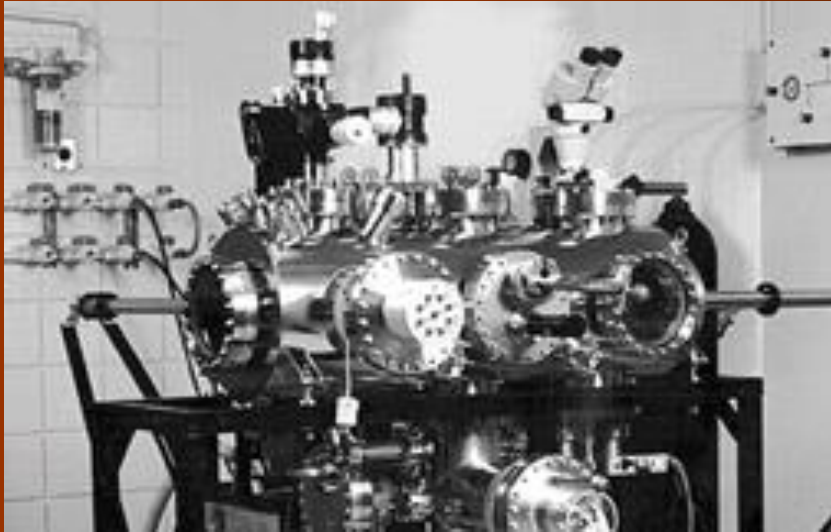


High T_c Superconductors

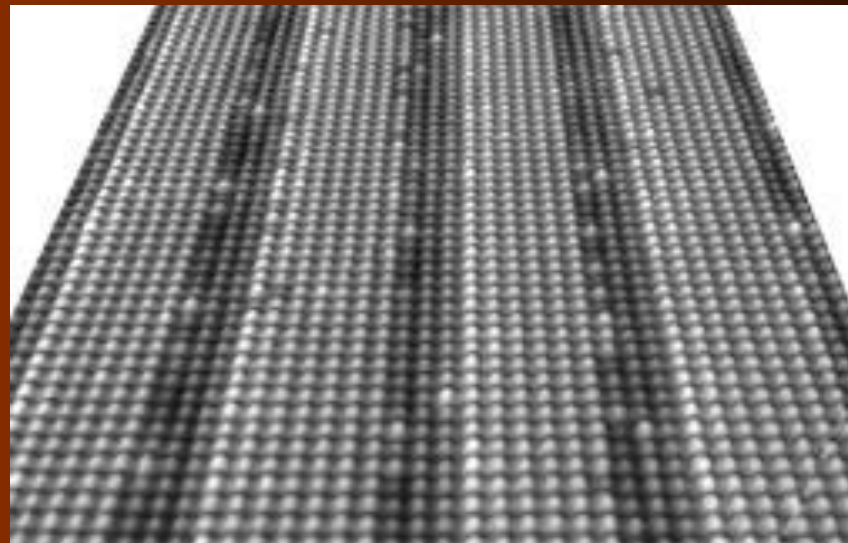


structured 1,000 A
cable for Bi-2212

Characterization at the Nanoscale



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



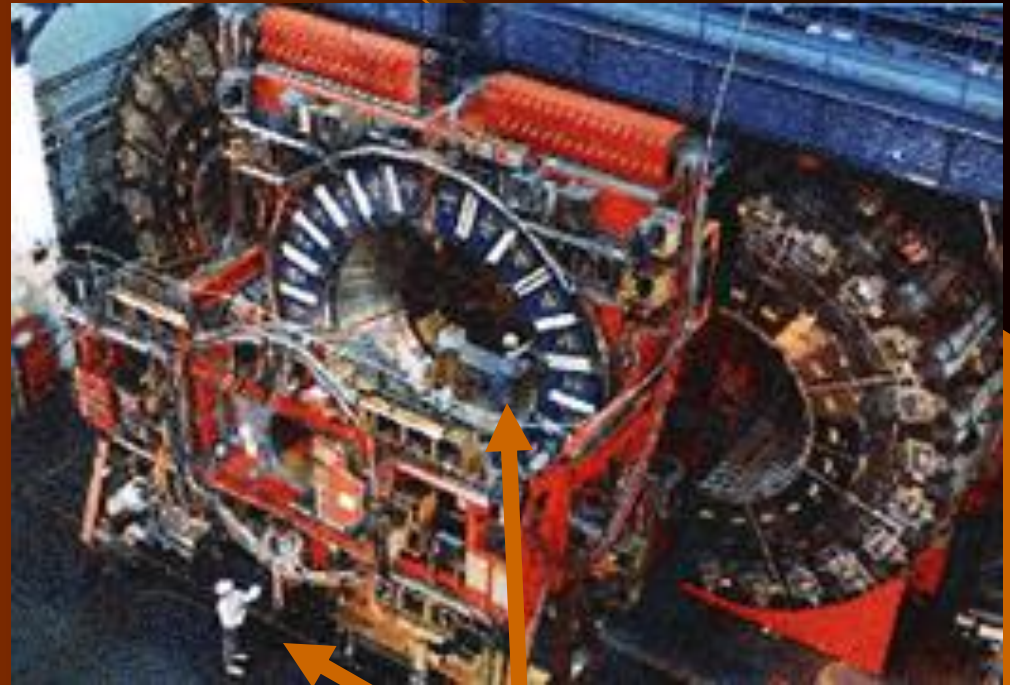
Supersymmetry Experiments



- 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

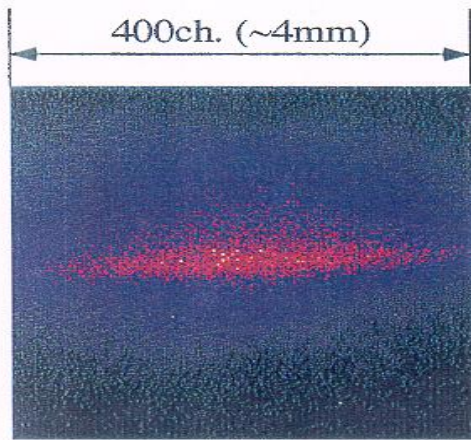


Yes that's a person!

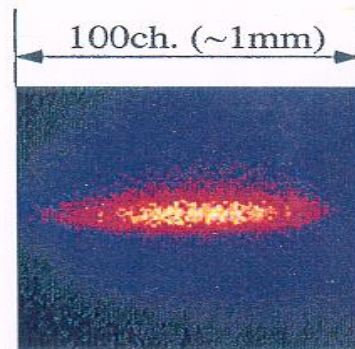
Applied Physics at Texas A&M

- 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)

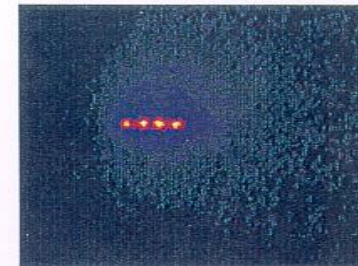
Fluorescence from laser cooled ions



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

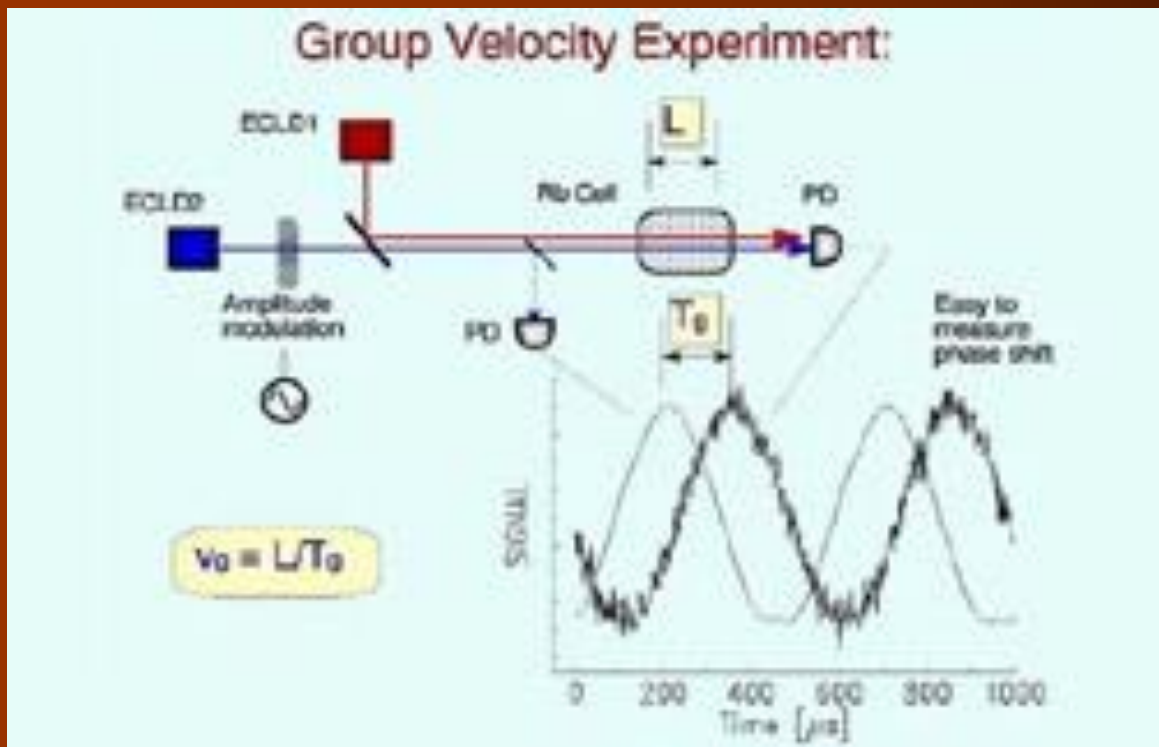


One of two
University based
Cyclotrons in
the US



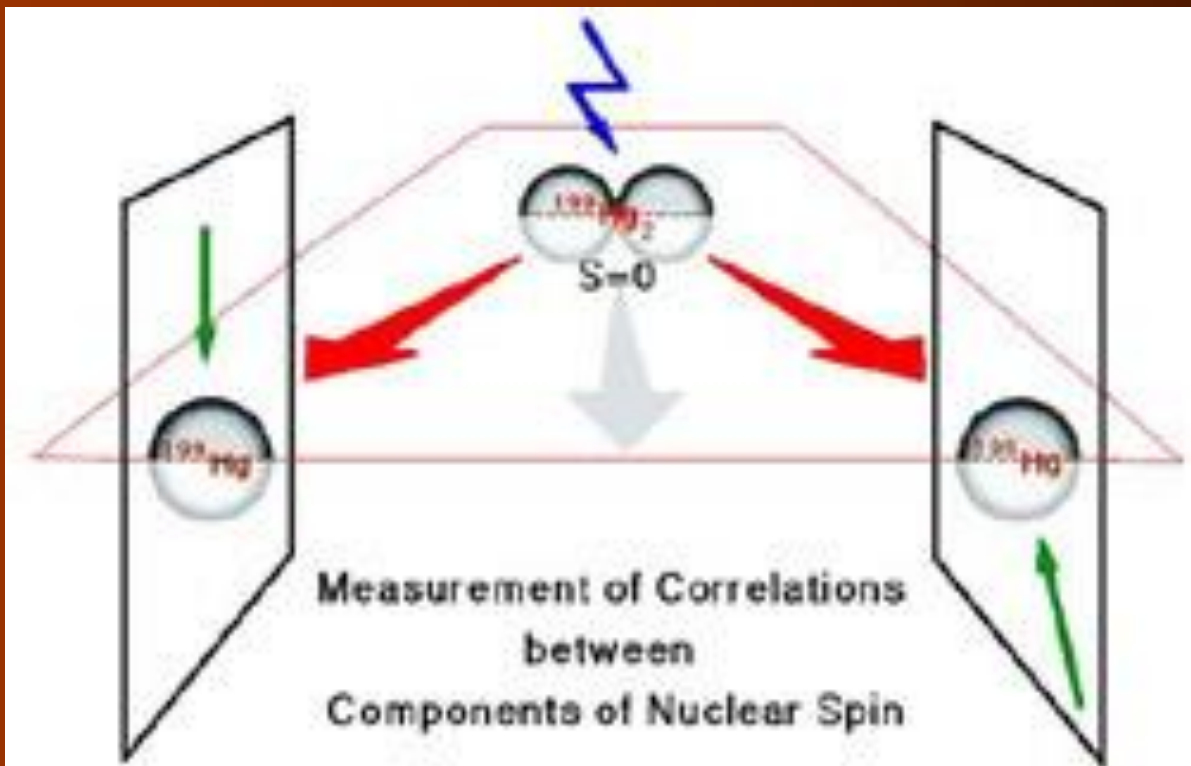
“Slow Light”

Welch: Group Velocity of Light can be reduced



Quantum Mechanical Foundations

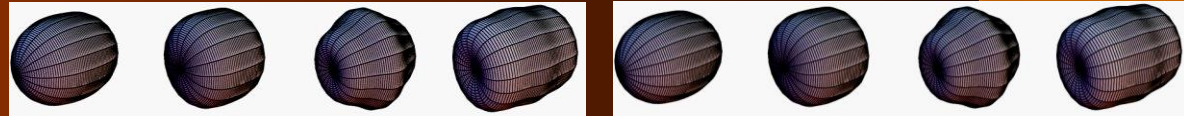
Fry, Walther: Einstein-Podolsky-Rosen
Experiment based on atoms



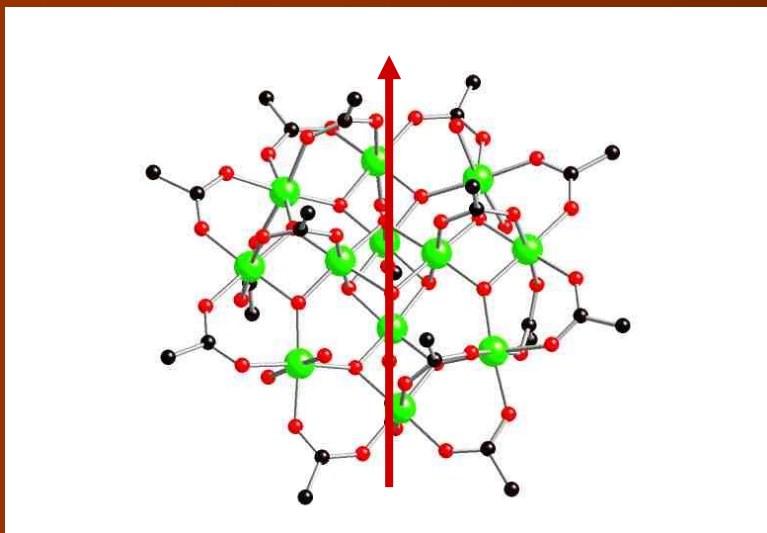
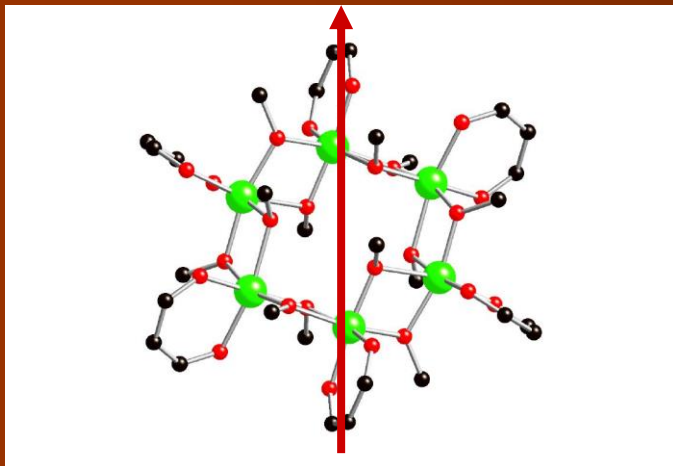
Collinear Raman Generator



- 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

