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

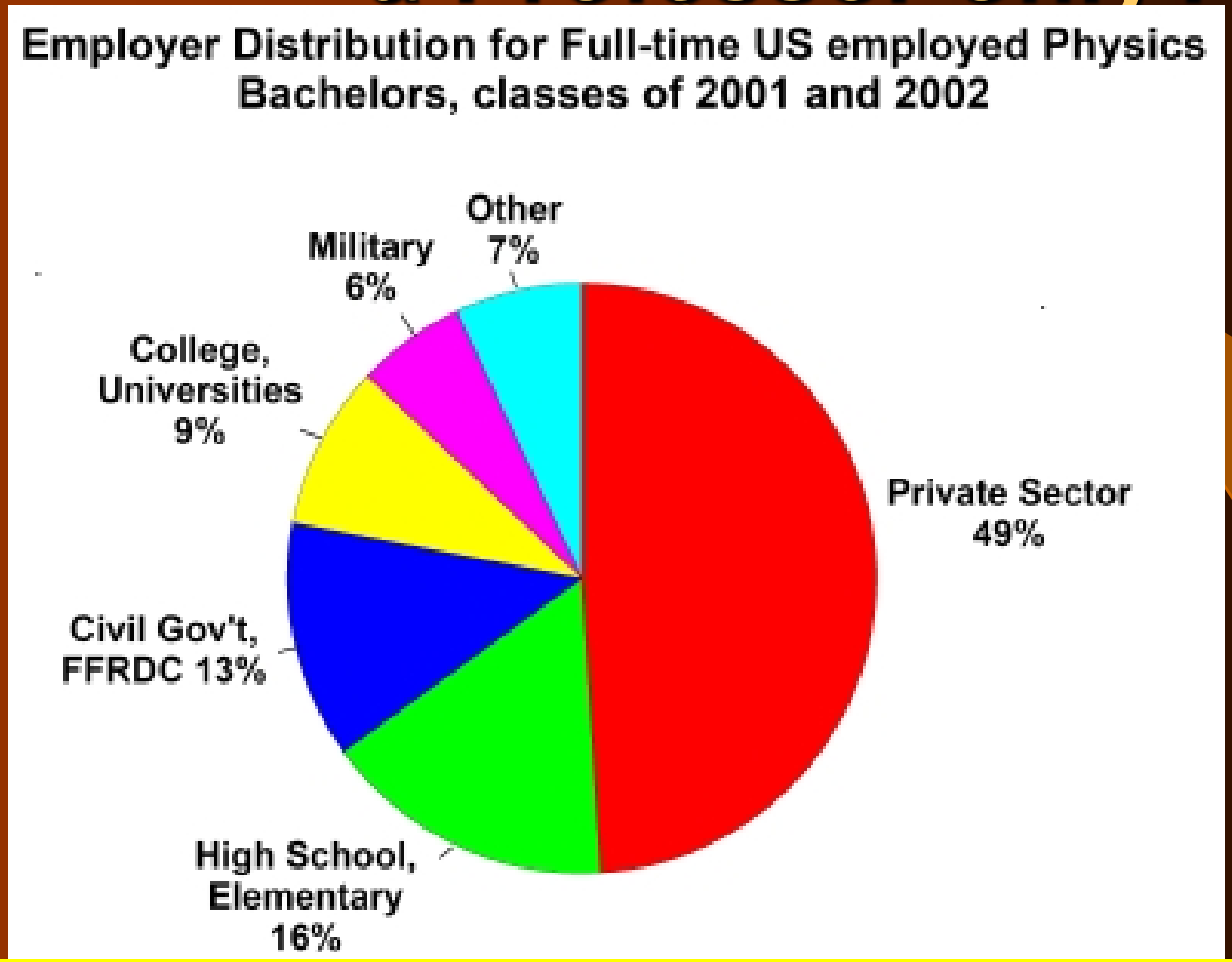
3. ***Money:***
   - ***The salaries for people with physics degrees aren't good***
4. ***Uhmm… Is it any fun?***
   - ***What do professors DO anyway?***
   - ***I've heard about some cool physics things but they aren't relevant to the "real world"***
   - ***The cool stuff isn't covered in any of the 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!



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**

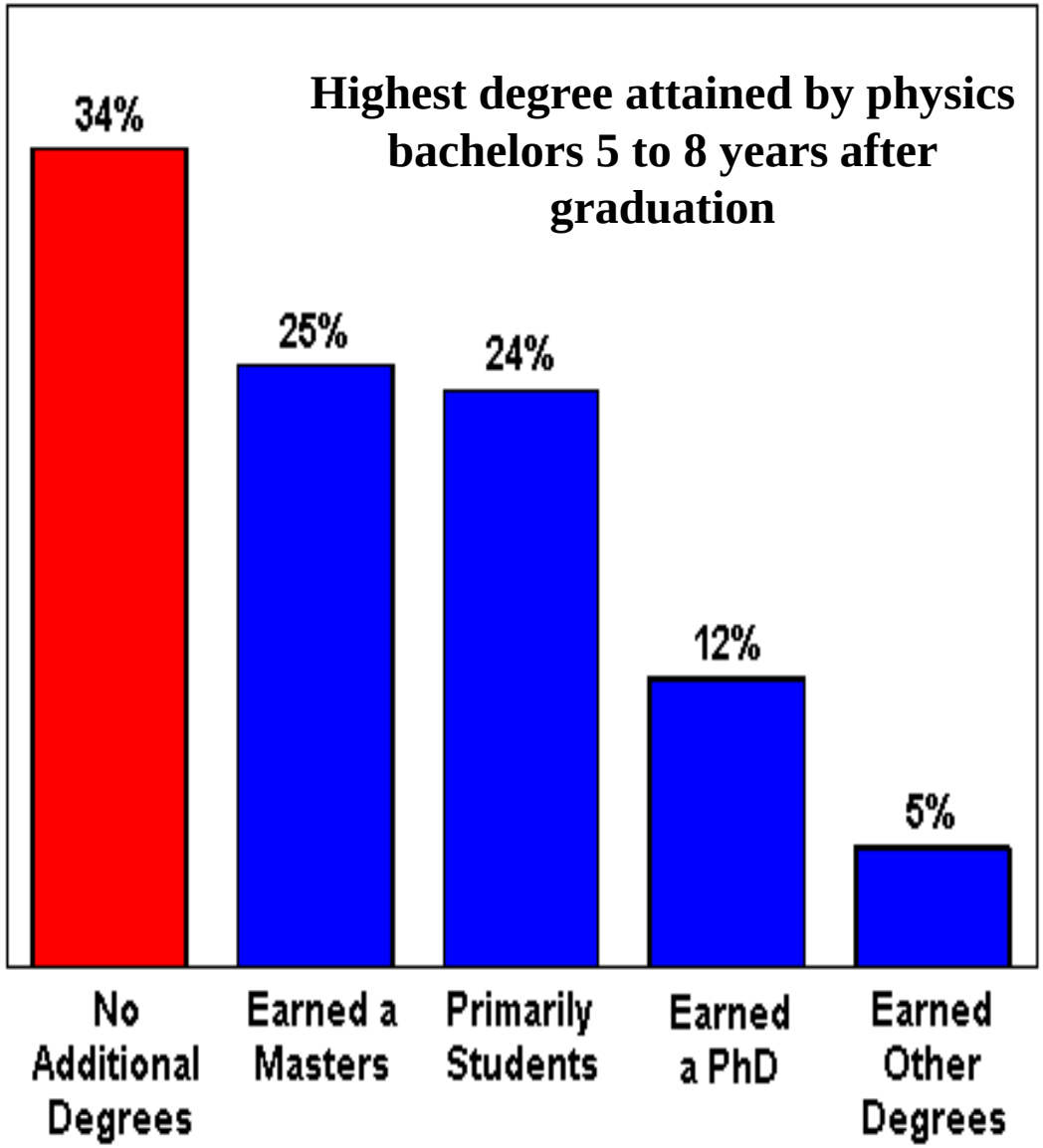
Ok… what kind of job?

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
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 things I might do?

A: Yup!!!

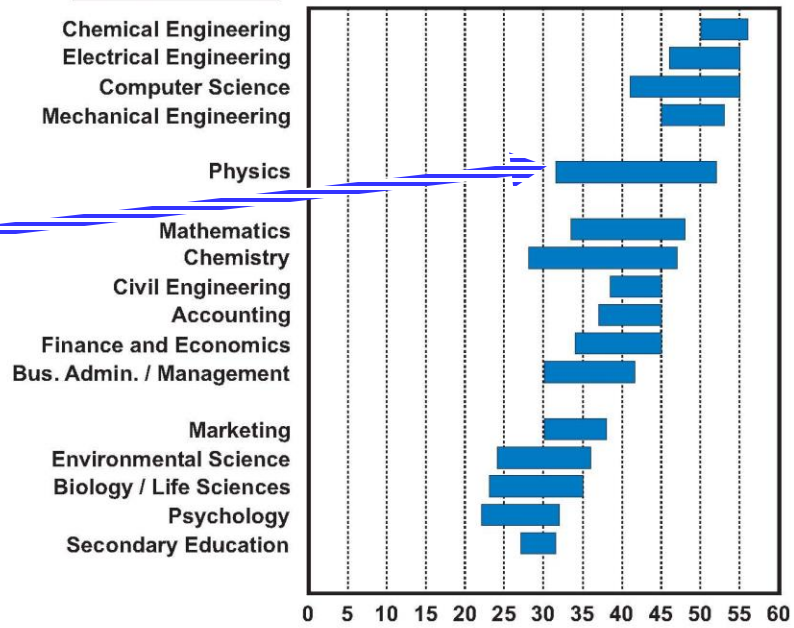
PHYSICS TRENDS

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.

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.

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

PHYSICS TRENDS

Contact: Raymond Y. Chu
rchu@aip.org

Winter 2004

PhD Salaries 10 Years Later

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 Obervatory.

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 $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…

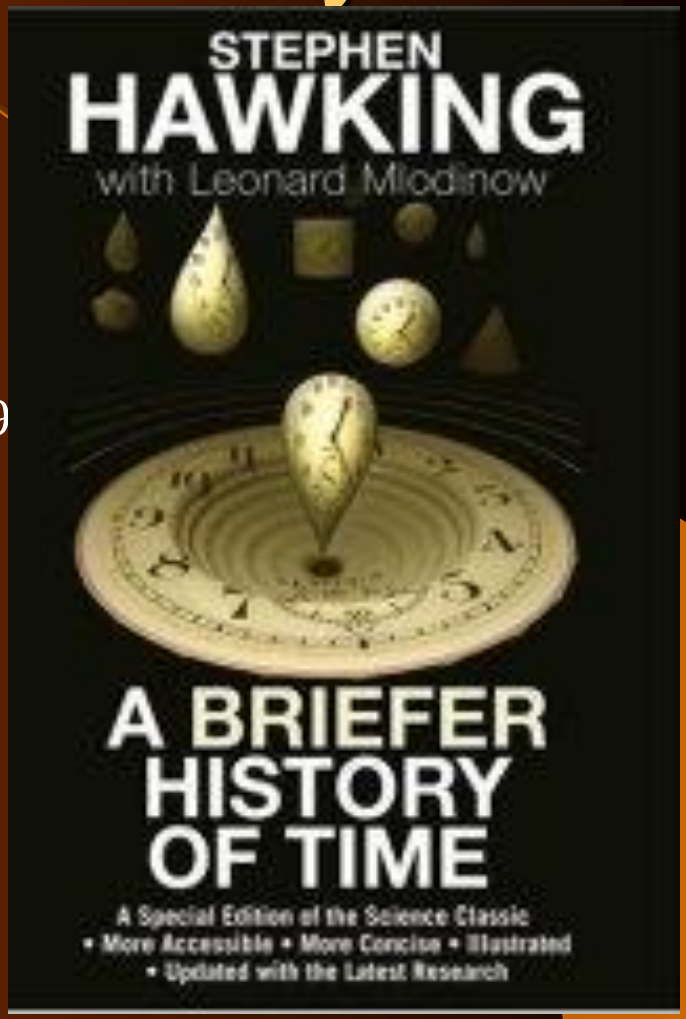
What are the interesting physics areas?

- **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"*
- Cross listed as Physics 289 and Astronomy 289
  - Tier 2
- 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/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!

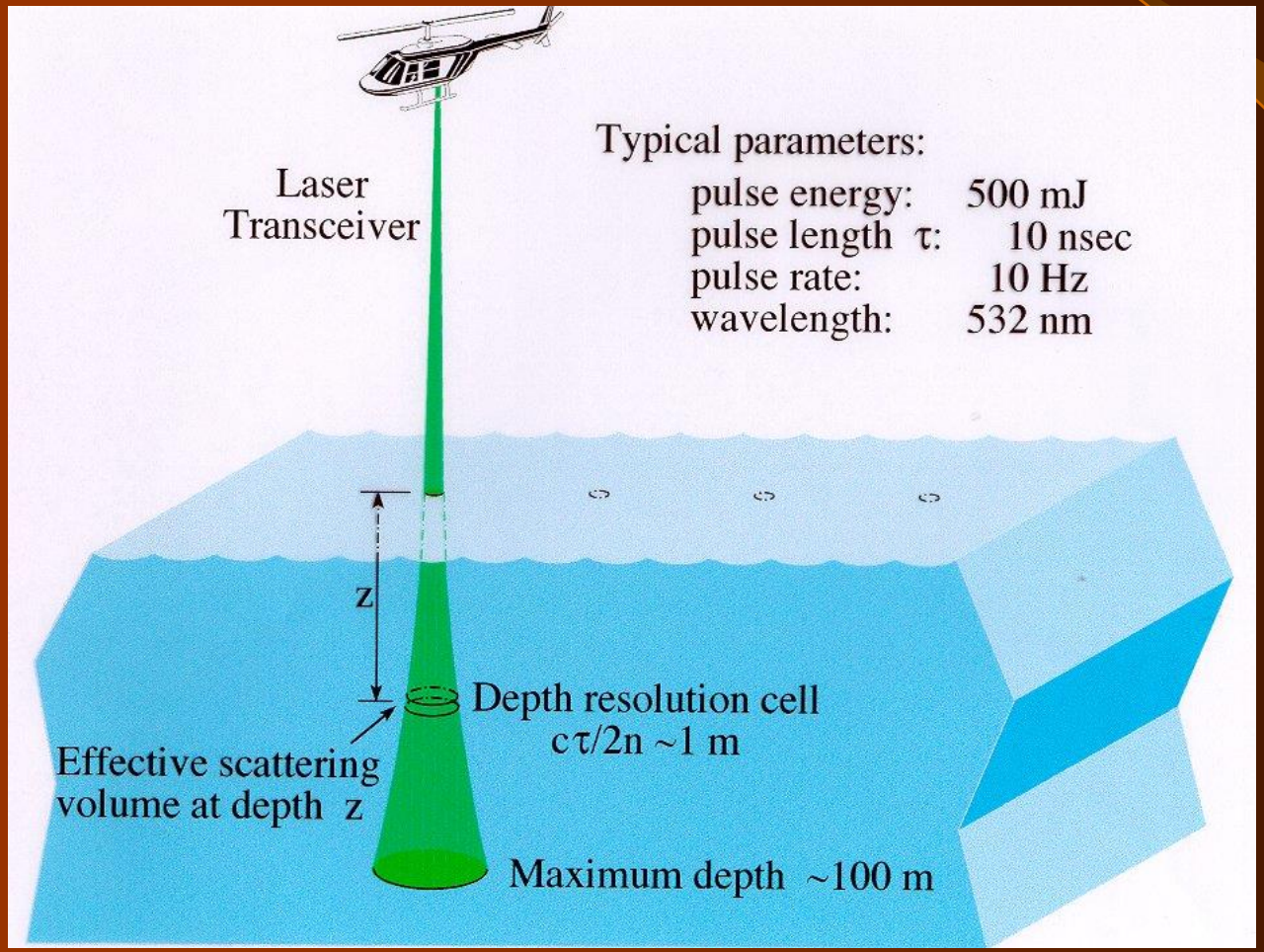
Extra slides on some of the research we do here at the Physics Department at Texas A&M University

A “Theory of Everything”

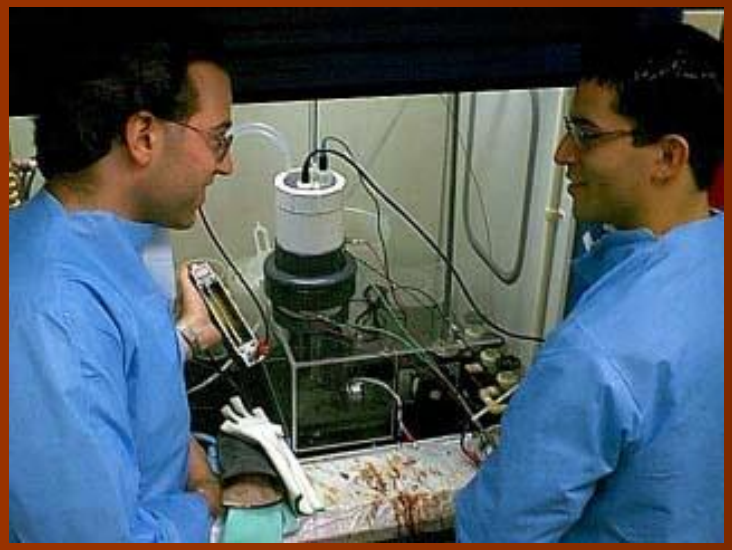
String Theory, Grand Unified Theories, Theory of everything…

Ocean Temperature Profile

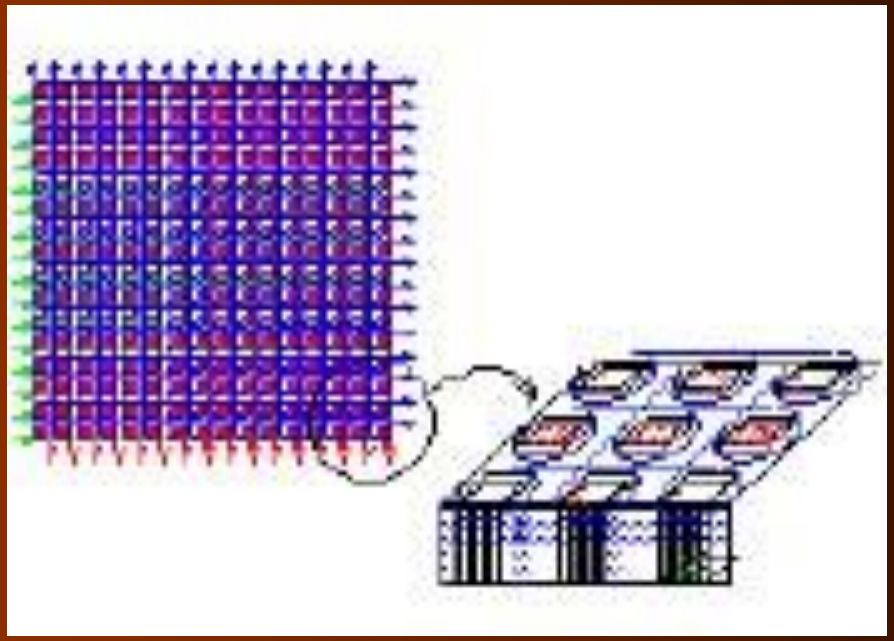
Remote
Laser Sensing



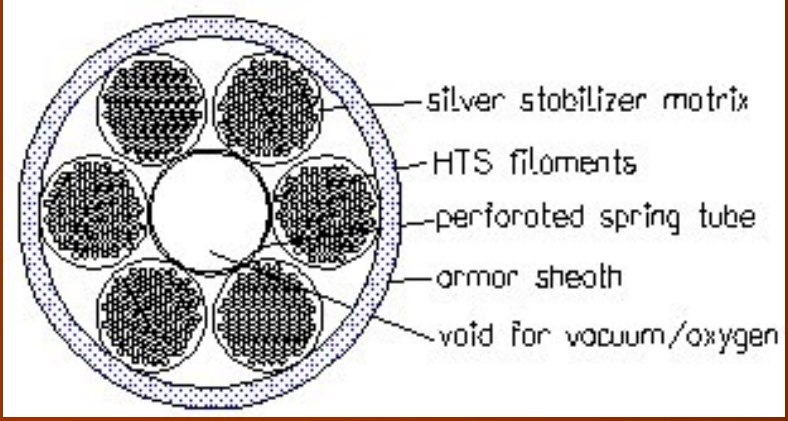
DNA Sequencing



lab-on-a-chip using nanotechnology

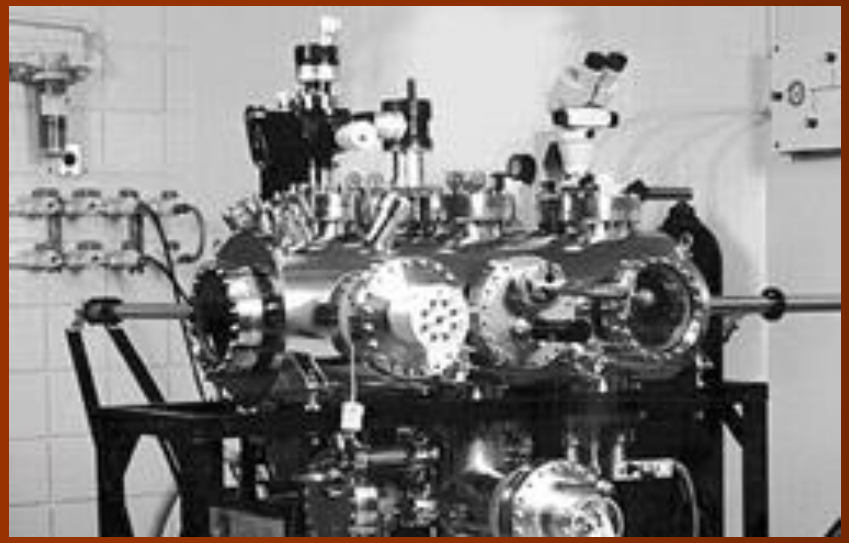


High T_c Super-conductors

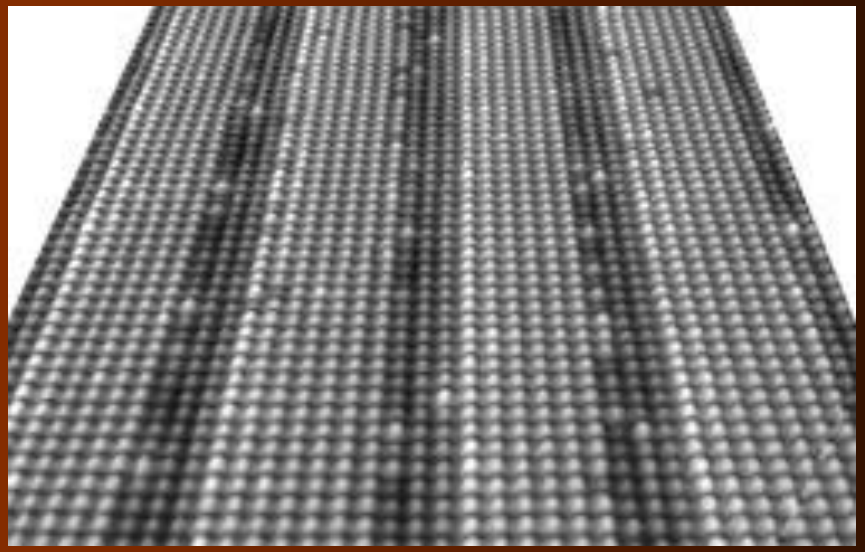


structured 1,000 A cable for Bi-2212

Characterization at the Nanoscale

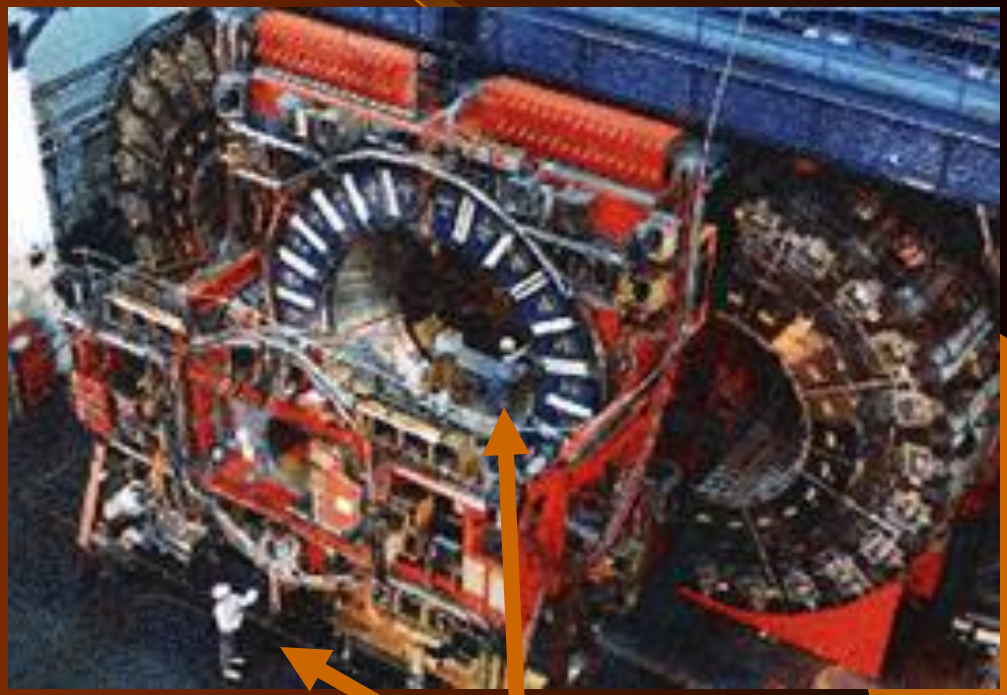


Scanning Tunneling Microscopy e.g. an atomically flat surface of GaSb/InAs



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**

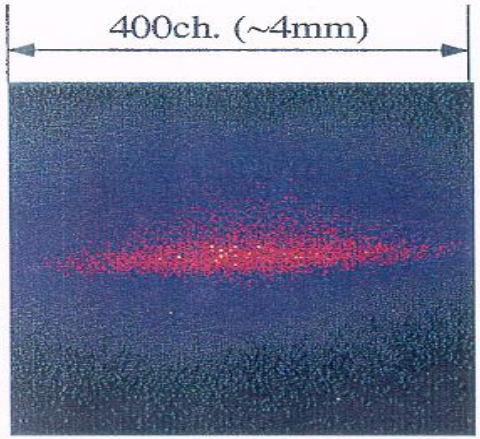


Yes that's a person!

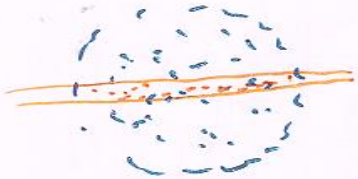
Applied Physics at Texas A&M

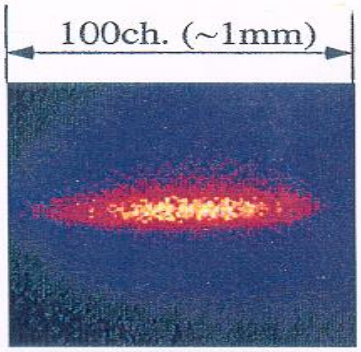
- Physics is crucial to many important advances
  - Computing (classical and quantum)
  - DNA sequencing and other biotech areas
  - Laser Remote Sensing
  - Magnetic Devices and Data Storage
  - Nanotechnology and Sensing
  - Optical Technology
  - Superconductivity (low T_c and high T_c)

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

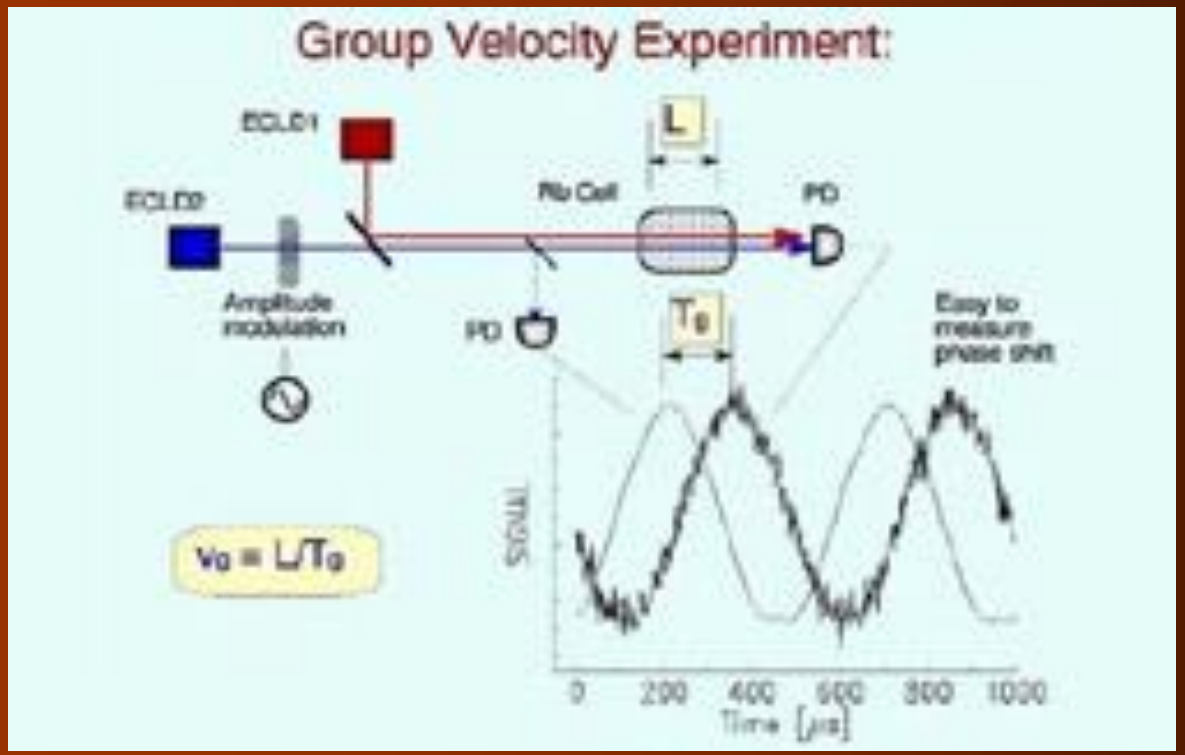
Space charge distributions in a linear RF ion trap (storage time ~40 sec)

The Cyclotron

One of two University based Cyclotrons in the US

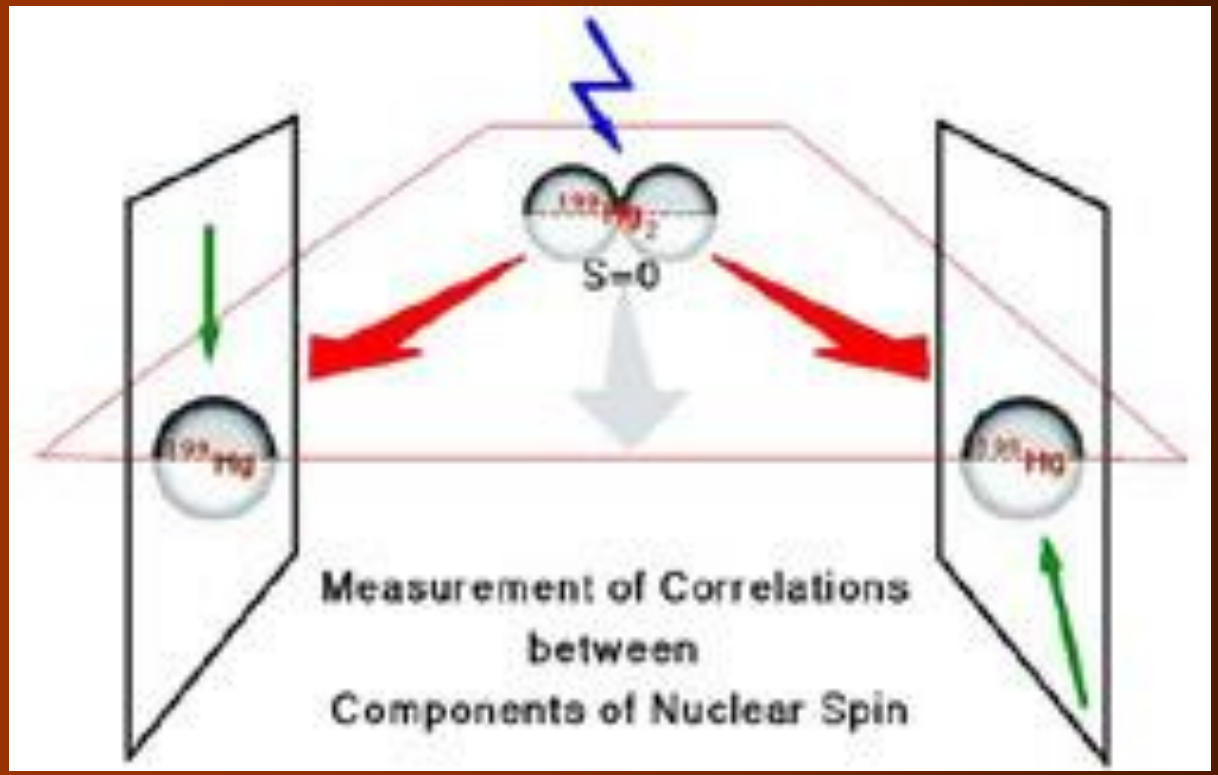
“Slow Light”

Welch: Group Velocity of Light can be reduced



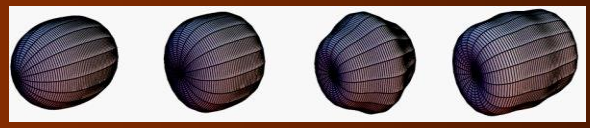
Quantum Mechanical Foundations

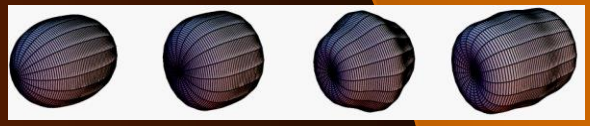
Fry, Walther: Einstein-Podolsky-Rosen
Experiment based on atoms



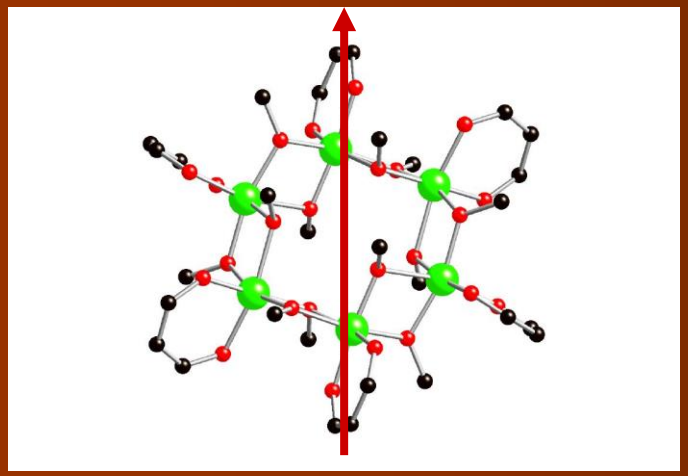
Collinear Raman Generator

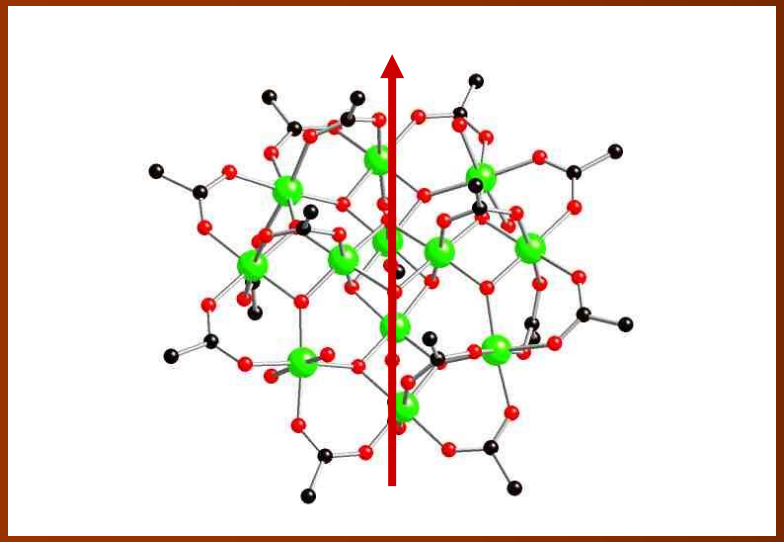
- A new light source to study new physics
- Extension of EIT ideas to molecular systems
- Photoionization with single-cycle pulses.
- Possible extensions of our technique:
  1. studying complicated motion of complex molecules
  2. probing ultrafast electronic dynamics in atoms.





Devices based on Molecular Nanomagnets





Large Magnetic Moment

Potentially useful for:

- Magnetic storage
- Quantum Computing

Nanomagnetic Sensing

Teizer: Micro- and NanoSQUIDs