

# Cornell University

## Department of Physics

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Spin-Up Workshop  
Rutgers 2010

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# What is special about our program?

Great students and dedicate faculty

Liberal Arts


Flexibility:

Streams

Concentration

Encourage students to find way to make an impact using physics

**Physics**  
Education Concentration




**Program Requirements:**

- 2 semesters Quantum Mechanics (Phys 310a and Phys 310b)
- 2 semesters Electricity and Magnetism (Phys 312 or Phys 312T)
- Classical Mechanics (Phys 314 or Phys 314b)
- Vector Calculus and Linear Algebra (Math 219 and 220 or Math 192 and 240)
- Applied Mathematics (for example, AEP 3201/3220)

The Cornell Teacher Education program involves a BA in physics, an education minor, and a year Master of Arts in teaching program, leading to full NYST certification.


**Physics**  
Astronomy Concentration



**Program Requirements:**

- 2 semesters Quantum Mechanics (Phys 310a and Phys 310b)
- 2 semesters Electricity and Magnetism (Phys 312 or Phys 312T)
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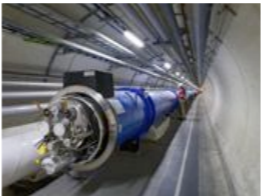
**Physics**  
Physics Concentration



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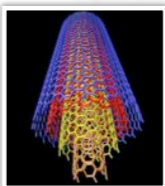
**Physics**  
Physics Concentration



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**Physics**  
Physics Concentration



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**Physics**  
Physics Concentration



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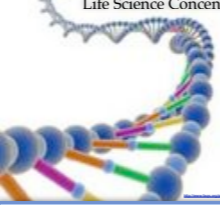
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35 more credits of Physics numbered 3000+ Must include Phys 4410 (in addition to previous lab) - you may take Phys 4410 multiple times.

**Outcomes:** Graduate: School in Physics, Applied Physics, Astronomy, Mathematics, Engineering, or related field, Government or Academic Research, Industrial Research and Development, Management, Consulting, Software Development, Technical Sales, Finance

www.physics.cornell.edu/undergraduate

**Physics**  
Life Science Concentration



**Program Requirements:**

- 2 semesters Quantum Mechanics (Phys 310a and Phys 310b)
- 2 semesters Electricity and Magnetism (Phys 312 or Phys 312T)
- Classical Mechanics (Phys 314 or Phys 314b)
- Vector Calculus and Linear Algebra (Math 219 and 220 or Math 192 and 240)
- Applied Mathematics (for example, AEP 3201/3220)

35 credits of Life Sciences (Typically satisfied by courses required for medical school: General Biology, Chemistry, Organic Chemistry, and Advanced Biology)


\*Medical schools require 28 credits of these courses - see Health Career Advising or a Physics Advisor for specific requirements - typical courses would be Chem 207L, 208L, 307L, 308L, 204L, BioC 180L, 181L, 380L, 381L, and BioNS-340L.

Students in Phys 101/102 who are interested in the Physics major should consult with an advisor.

**Outcomes:** Medical/Veterinarian School, MD/PhD, Lab Tech, Medical Industry, Bio-Tech Industry

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**Physics**  
Mathematics Concentration



**Program Requirements:**

- 2 semesters Quantum Mechanics (Phys 310a and Phys 310b)
- 2 semesters Electricity and Magnetism (Phys 312 or Phys 312T)
- Classical Mechanics (Phys 314 or Phys 314b)
- Vector Calculus and Linear Algebra (Math 219 and 220 or Math 192 and 240)
- Applied Mathematics (for example, AEP 3201/3220)

35 credits of Mathematics 9 credits must be numbered 3000+

**Outcomes:** Graduate: School in Physics, Mathematic, or related field, Government, Academic, or Industrial Research, Computer Programming, Actuarial or Statistical Work, Finance

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# Who are our majors?

27 Seniors: 15 physics concentrators, 5 astronomy, 1 each Bio, CS, Music, Chem, ECE, Imaging and Meteorology

Female/Male ratio: 40%

28+ Juniors

27+ Sophomores (more joining)

Students declare as Sophomores/Juniors

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## What do they do after Cornell?

Graduate Schools

Private/Public Sector

<http://www.physics.cornell.edu/careers/outcomes/>

Boston University -- Physics  
Cal Tech -- Astrophysics  
Cal Tech -- Physics  
Columbia -- Physics  
Cornell -- Applied Physics  
Cornell -- Computer Science  
Cornell -- Education  
Cornell -- Operations  
Research  
Cornell -- Physics  
Cambridge -- Mathematics  
Duke -- Physics  
Georgetown -- Medicine  
Harvard -- Applied Physics  
Harvard -- Physics  
Max Planck Institute for  
Gravitational Physics --  
Physics  
Maryland -- Astrophysics  
Maryland -- Physics  
Michigan -- Physics

MIT -- Physics  
Penn State -- Acoustics  
Penn State -- Physics  
Pittsburgh -- Law  
Princeton -- Electrical and  
Computer Engineering  
Princeton -- Physics  
Princeton -- Physics  
Rutgers -- Biomedical  
Engineering  
Rutgers -- Neuroscience  
Southwest -- Bible College  
Vanderbilt -- Physics  
Tufts -- Education  
UC Berkeley -- Astronomy  
UC Berkeley -- Physics  
UC Irvine -- Physics  
UC Los Angeles -- Physics  
UC Santa Barbara -- Physics  
UC Santa Barbara -- Physics

UC Santa Cruz -- Physics  
University of Chicago -- Law  
University of Chicago --  
Physics  
University of Colorado at  
Boulder -- Applied  
Mathematics  
University of Colorado at  
Boulder -- Physics  
University of Washington --  
Physics  
Washington University in  
Saint Louis -- Physics  
Wisconsin -- Astronomy  
Wisconsin -- Physics

Apple -- Software Engineer  
Applied Materials --  
Engineer  
Booz Allen Hamilton --  
Consultant  
Cornell -- Lab Assistant  
Cornell -- Research  
Assistant  
Cornell NEPP --  
Dana-Farber Cancer  
Institute -- Lab Technician  
Dean & Company --  
Analyst  
Deloitte Consulting --  
Analyst  
Enrich Consulting --  
Analyst

Ernst and Young --  
Financial Analyst  
Institute for the Future --  
Research Assistant  
Jet Propulsion Laboratory  
-- Associate Engineer  
London Hospital --  
Postgraduate Assistant  
MIT Engineering --  
Hydrologist/CAD Technician  
MIT Lincoln Laboratory --  
Assistant Researcher  
Stego Industries --  
Regional Sales Manager  
Teach for America --  
Secondary School Teacher  
General Engineer

US Dept of Energy --  
Senior  
WVU Medical College --  
Teaching Assistant  
Yale Press -- Assistant

# What are our concerns

## Community (recall: diverse directions of our majors)

- competitive vs collaborative
- inclusiveness
- helping students find right stream
- find ways for students to be integral part of department



## Details (details matter)

- homework systems
- fine curricular issues (ex. which intro course gets thermodynamics)
- continuity
- interplay between Engineering Physics program and Physics

# Give Students Resources

Info booklets

SPS listserve

Posters Advertising Program

Info sessions

Web site

Clearly lay out  
course flowchart

Clear directions  
on finding research

Career guidance

Remind them often  
why they love physics

**In the absence of good information students  
invent their own (often misguided) narrative**

# Listen to students

## Info sessions

- Beginning of year for freshmen
- Career Session in September

DUS meets one-on-one with all prospective majors

## Online feedback

- Very effective in P1101/2 (intro seq for life science students)
- GOOGLE docs works great

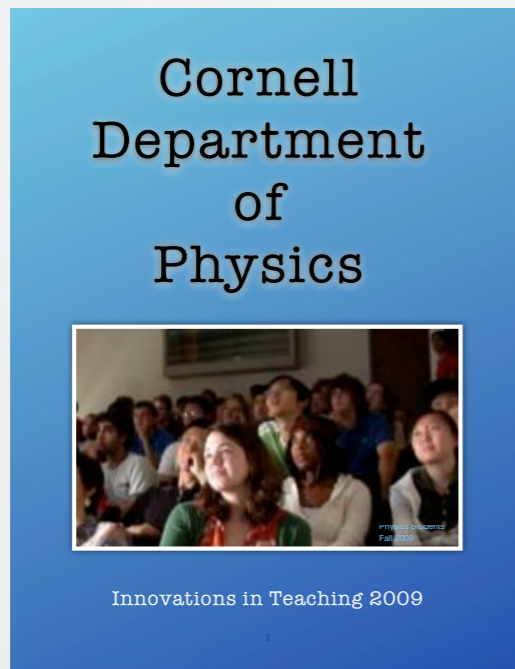
## Invite Students to Lunch



**Gender Equity Conversation**  
(learned stuff which was not just about Gender Equity)

# Inspire faculty to make efforts

Advertise Success



Regularly discuss issues



Give them more personal contact with students

- Research
- Outreach
- Social

# Give Students Responsibility

SPS

Helping with recruiting

- Meeting with prospectives
- Feedback on advertising material

Research

Mentoring Opportunities

Outreach

Teaching Opportunities

Opportunities to improve teaching labs

- Mixed results with having students help document existing labs
- Better results with having students help develop new labs



# Big Success: study halls

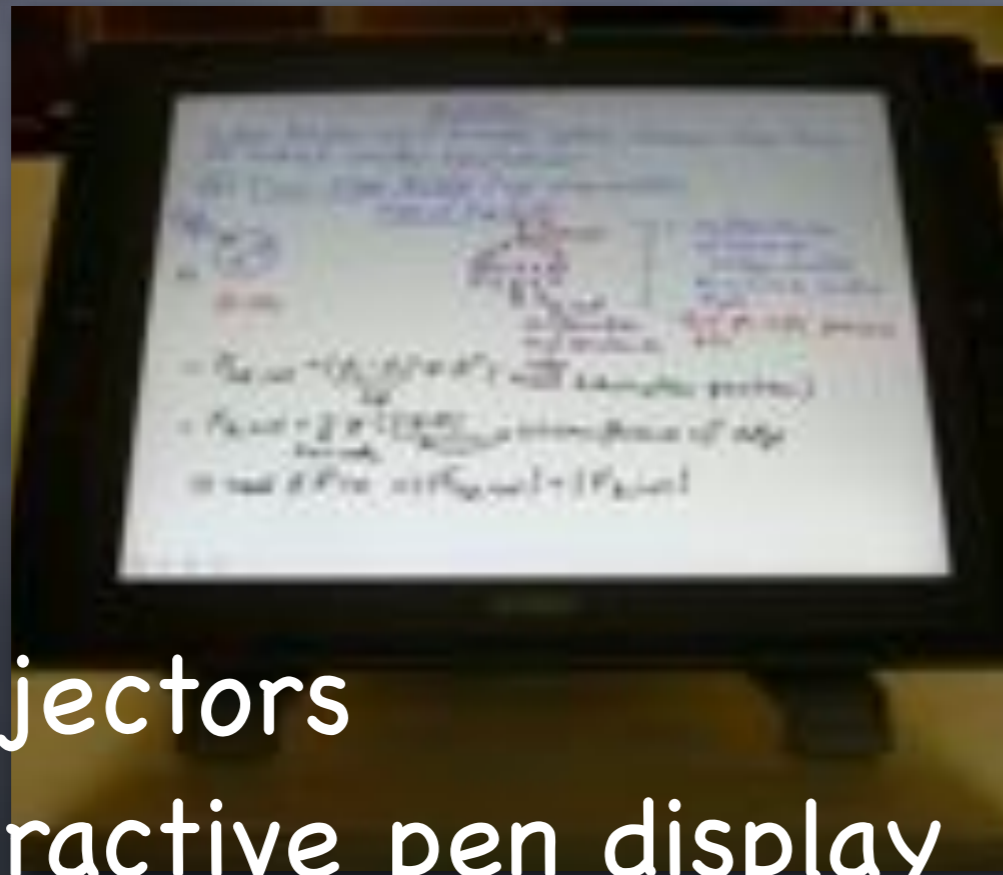


Honors class (50 students)  
Book room on Thurs. afternoon  
(HW due on Friday)  
TA available for 3 hours, faculty 1 hour

50% weekly participation  
Good for morale and learning  
Great collaborative process  
Liked it more than "office hours"

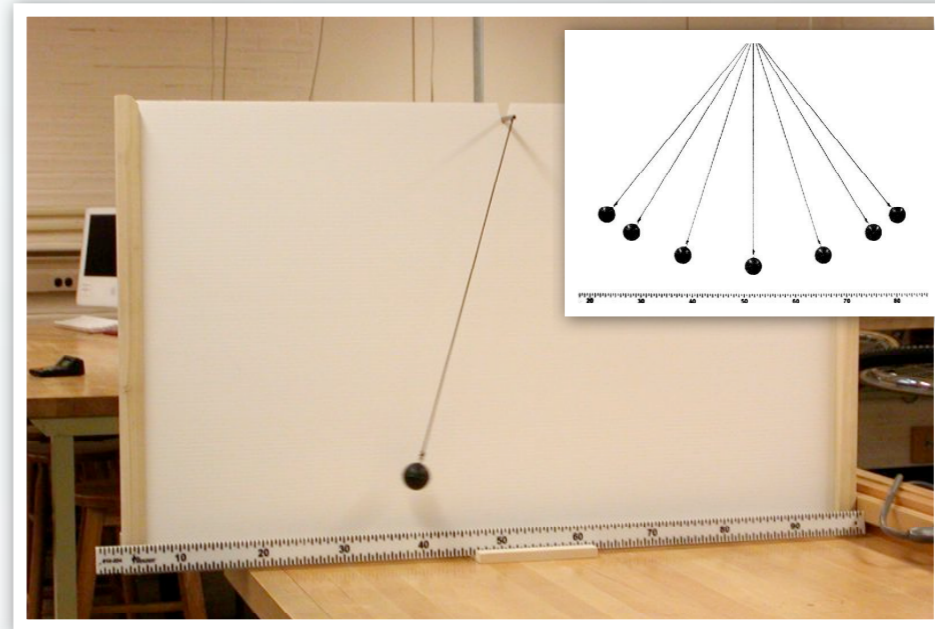
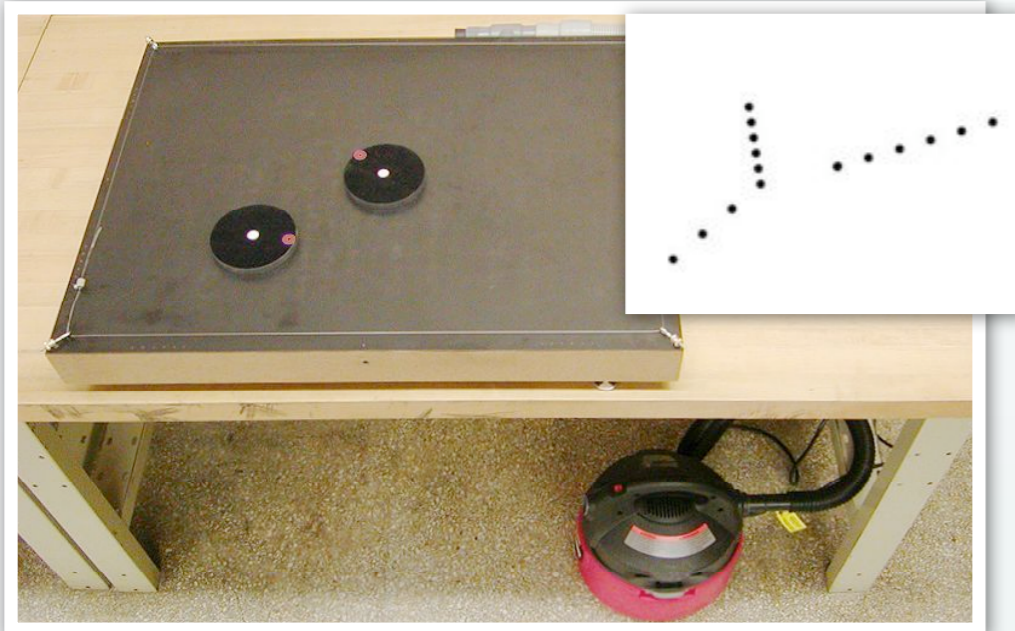
(Same cohort responded poorly to cooperative learning exercises in recitation)

# Multi-Projector - Interactive Pen Display Setup



- 1 PC
- 3 Projectors
- 1 interactive pen display

# Motion Capture Labs



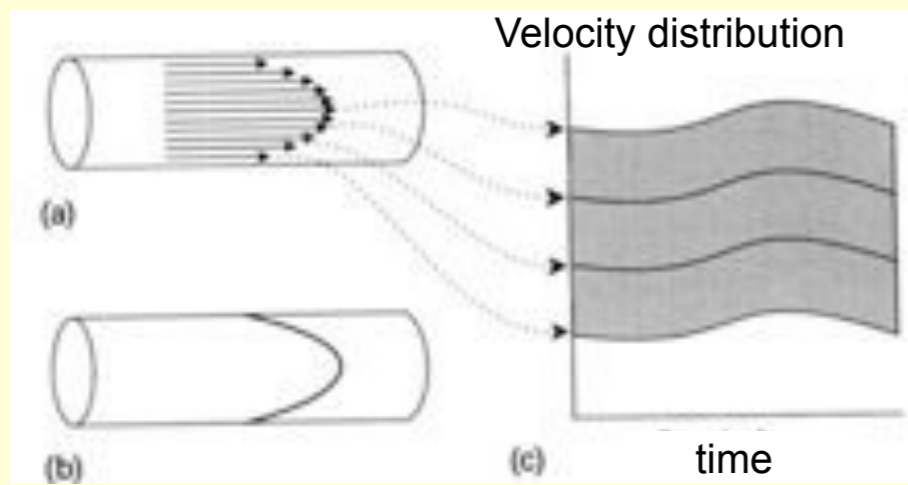
Make Strobe diagrams from 2D motion -- overlay frames of video

All analysis is manual (graphical finite differences)

# In-lecture "Applications"

## Doppler Ultrasound Imaging

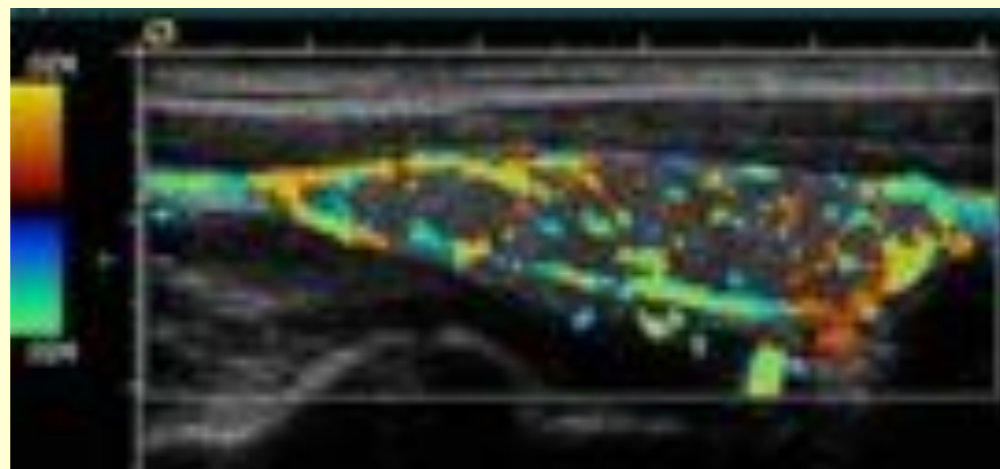
- Used to image blood flow and flow profiles.
- **Flow velocity  $\propto$  Doppler frequency shift**



## Blood flow in the carotid artery and jugular vein:



## Blood flow in a healthy thyroid gland:



# Pre-lecture "Slideshows"

## Homework assignments:

- Posted on web -- 2 weeks before due date (except for first assignment). Due every Friday in lecture. First HW Due this Friday!

## Cooperative Learning Problems/Tutorials:

- Assigned in recitation. You'll work on them in teams. Grading based on demonstrated effort.

## Labs

- First Lab: Feb 6. Pre-Lab questions must be completed by the start of each lab. Completion of all labs is mandatory.

## Exams

- Prelims: March 2, 7:30pm; April 6, 7:30pm
- Final: May 10

Collaboration on homework, and labs is strongly encouraged. You must independently write up homework and lab reports.

Proteins are made of amino acids, which contain nitrogen. What fraction of the nitrogen in your body has been through an ammonia factory?

Roughly 50%

Trivia

Announcements

Cartoons

