Community building
Applied Physics

a serious problem...

2007–2010

admitted/matriculating students by faculty

percent retained
Graduate student involvement:

- Colloquium
- Big brother/sister program
- Social events
- Other activities
Social events for graduate students

- BB/BS welcome event at Tommy Doyles
- Fall AP social
- “Dinner with strangers” at John Harvard’s
- Spring BB/BS event
- Year-end pizza with G1s
Connecting with faculty

- Post colloquium social hour in Queens Head Pub
- Applied Physics Fest
Other activities

• T-shirt contest

• Journal club
Faculty Lunches

- Curriculum
- Searches
PHOTONICS
Faculty Lunches

PHOTONICS

NANOSCALE ELECTRONIC DEVICES
Faculty Lunches

Diagram:

- Photonics
- Nanoscale Electronic Devices
- Nanoscale Structures
- Bio & Soft Matter
APPLIED PHYSICS MODEL PROGRAMS

The Applied Physics Ph.D. program comprises four areas of research: Photonics, Nanoscale Electronic Devices, Nanoscale Structures, and Biological and Soft Matter Physics. The model programs for each of these areas consists of a number of core courses (defining the area), fundamental courses (basic physics knowledge required), and elective courses.

A total of 10 courses are required to fulfill the course requirements for a Ph.D. in Applied Physics. Only two courses below the 200 level may be included. Students who need additional 100-level courses may take more than 10 courses. For students whose thesis research does not involve any experimental work, at least one course must involve performing experiments (e.g., an experimental 299).

Please note that these programs serve as models only. The final program final curriculum should be determined in consultation with your advisor.

PHOTONICS

Photonics is a broad and diverse field at the crossroads of Electrical Engineering, Applied Physics and Physics. The central focus of the proposed PhD model program in Photonics is on core courses, which capture the main thrusts of this field, emphasizing the state-of-the-art of new discoveries in optical physics and photonics technology. These core courses require knowledge of fundamentals such as Quantum Mechanics, Solid-state Physics and Electromagnetism. A list of electives to provide additional breadth complements the program.

Associated Faculty
Federico Capasso
Jene Golovchenko
Lene Hau
Eric Mazur
Marko Loncar
Peter Pershan

Core Courses
Three courses out of the following required.

- ES273 Optics and Photonics
- ES274 Quantum Technology
- ES275 Nanophotonics
- AP216 Modern Optics and Quantum Electronics
Model programs for 4 tracks:

- **2-3 core courses (AP)**
- **4 fundamental courses (track)**
- **electives**

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Model programs for 4 tracks:

- 2–3 core courses (AP)
- 4 fundamental courses (track)
- electives

examples for each track

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• ES276 Modern Optics and Quantum Electronics
• ES277 Applications of Modern Optics
Targeted Senior Search
Jennifer Lewis
Faculty Lunches

Broad
Junior Search
(in progress)

Targeted
Senior Search
Jennifer Lewis
Community building

- AP Physics Fest
- Social Hour in Queen’s Head Pub
Community building

- AP Physics Fest
- Social Hour in Queen’s Head Pub
- “Take a colleague to lunch” program
- Collaborative grants
Plans

- Curriculum review
- Teaching week
- AP Student survey
- AP50
• Learning goals for tracks

• Course assessment: Review syllabi, reduce redundancy

• Define core AP program?
Core AP program:

- Unites AP graduate students
- Maximizes their flexibility
- Qualifying exam consistency?
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## Curriculum review

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Curriculum review

Must keep in mind:

• Potential benefits to students

• Flexibility of program
Curriculum review

Applied Physics 50
Intro Physics Courses

Four tracks, all modeled after standard course for majors
current approach doesn’t satisfy needs of SEAS students
Goals

• address engineering student needs
Goals

- address engineering student needs
- pull freshmen into science & engineering
Intro Physics courses

Need to:

- align goals to students’ needs and expectations
- change the approach
- redesign the learning space
Seminar course
students learn content through projects
Applied Physics 50

- two-semester course, six projects
- each project relates to a different engineering field
- opportunity to develop important skills
Mission to Mars
design and plan a manned or unmanned mission to Mars
Course design

- Survey faculty for expectations
- Design Learning Goals (& think about assessment)
- Determine resources needed & assemble team
- Design projects
- Design project activities
- Develop Evaluation Process
INTRO PHYSICS COURSE SURVEY

Thank you for participating in this survey. Your answers are confidential.

* Required

Your name: *

Your e-mail address: *

Which course(s) do you teach that list(s) Physical Science, Physics 11, or Physics 15 as a prerequisite? *

List the course number only (for example, Physics 183). Course list url:
http://www.registrar.fas.harvard.edu/fasweb/courses/main.jsp?host=ugrad&subcat=courses

In your experience, how well do the prerequisite physics courses prepare students for your course? *

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32 (out of 55) responses
Course design

32 (out of 55) responses

- Clear guidance on content
- Less clear on desired outcomes
Course design

Setting learning goals

Grant Wiggins and Jay McTighe, *Understanding by Design* (Prentice Hall, 2001)
Course design

Backward design

desired outcomes
Course design

Backward design

acceptable evidence → desired outcomes
Course design

Backward design

- instructional approach
- acceptable evidence
- desired outcomes
Learning spaces

4000 years of learning space history in 5 seconds

Palace school, Mari, Syria, 2100 BC
Learning spaces
Learning spaces
Learning spaces
Learning spaces

We can do better than this!
Case study classrooms @ HBS
Classification

faculty centered

student centered

hybrid
Classification

faculty centered

information transfer

student centered

interaction

hybrid
thanks to all my AP colleagues for being so open-minded!

Follow me! eric_mazur