

TEACHING AND RESEARCH: INSEPARABLE RESPONSIBILITIES OF THE MODERN PHYSICIST

**Catherine H. Crouch
Eric Mazur**

Harvard University

**APS Centennial Meeting
23 March 1999**



Outline

- ▶ **We have a problem**

Outline

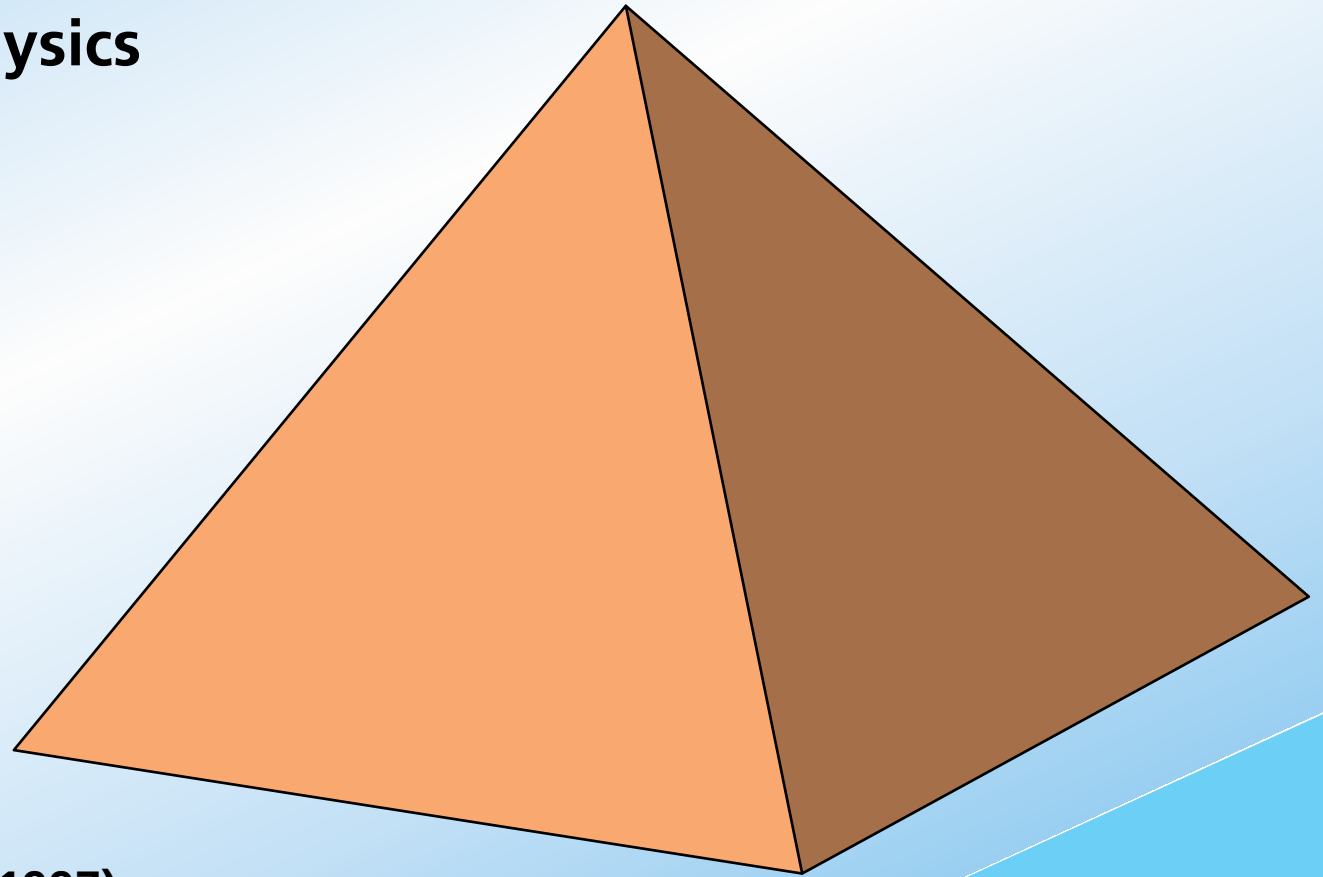
- ▶ **We have a problem**
- ▶ **Why?**

Outline

- ▶ **We have a problem**
- ▶ **Why?**
- ▶ **So what should we do?**

We have a problem

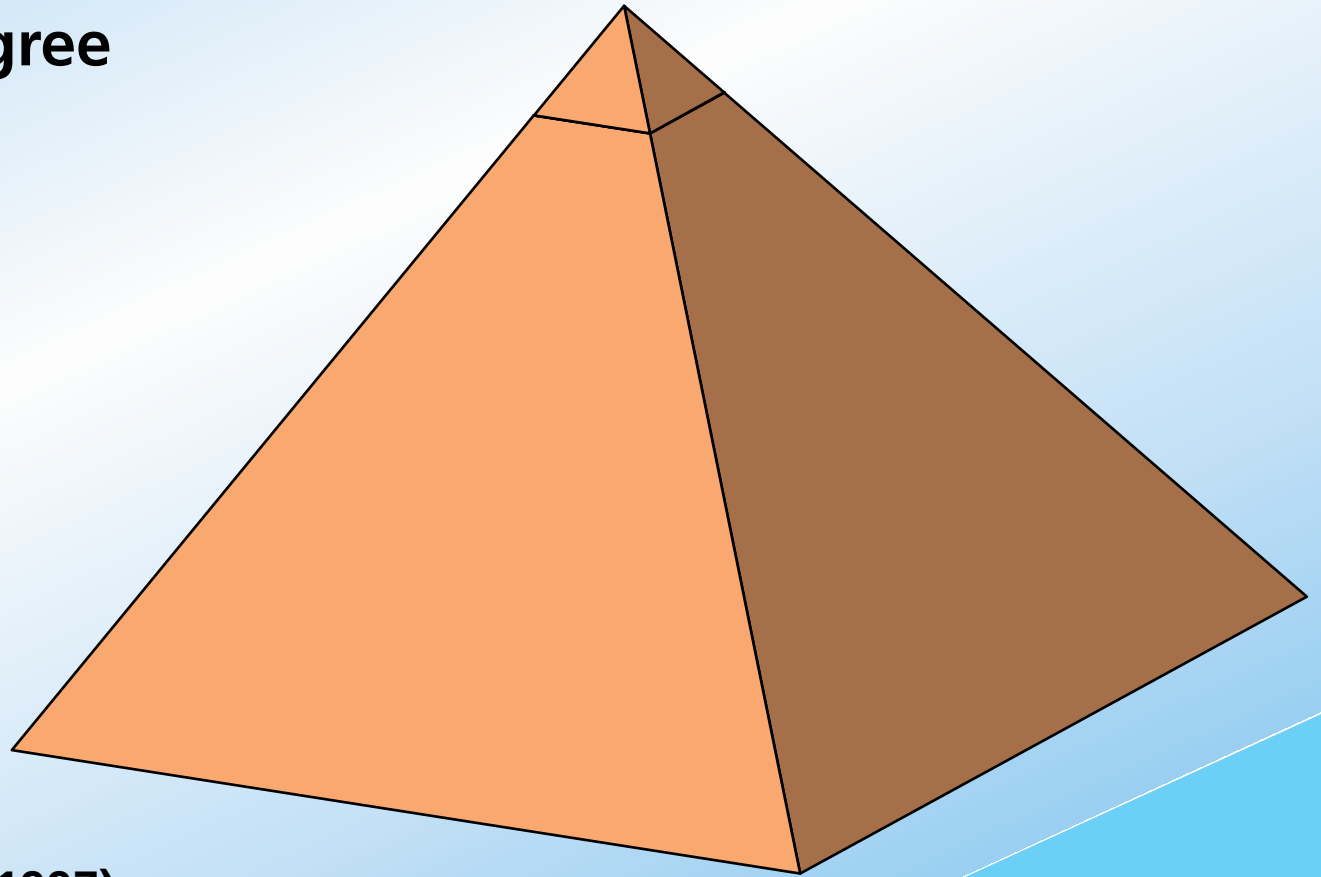
**380,000 students take
introductory physics
each year...**



AIP Report R-151.33 (1997)

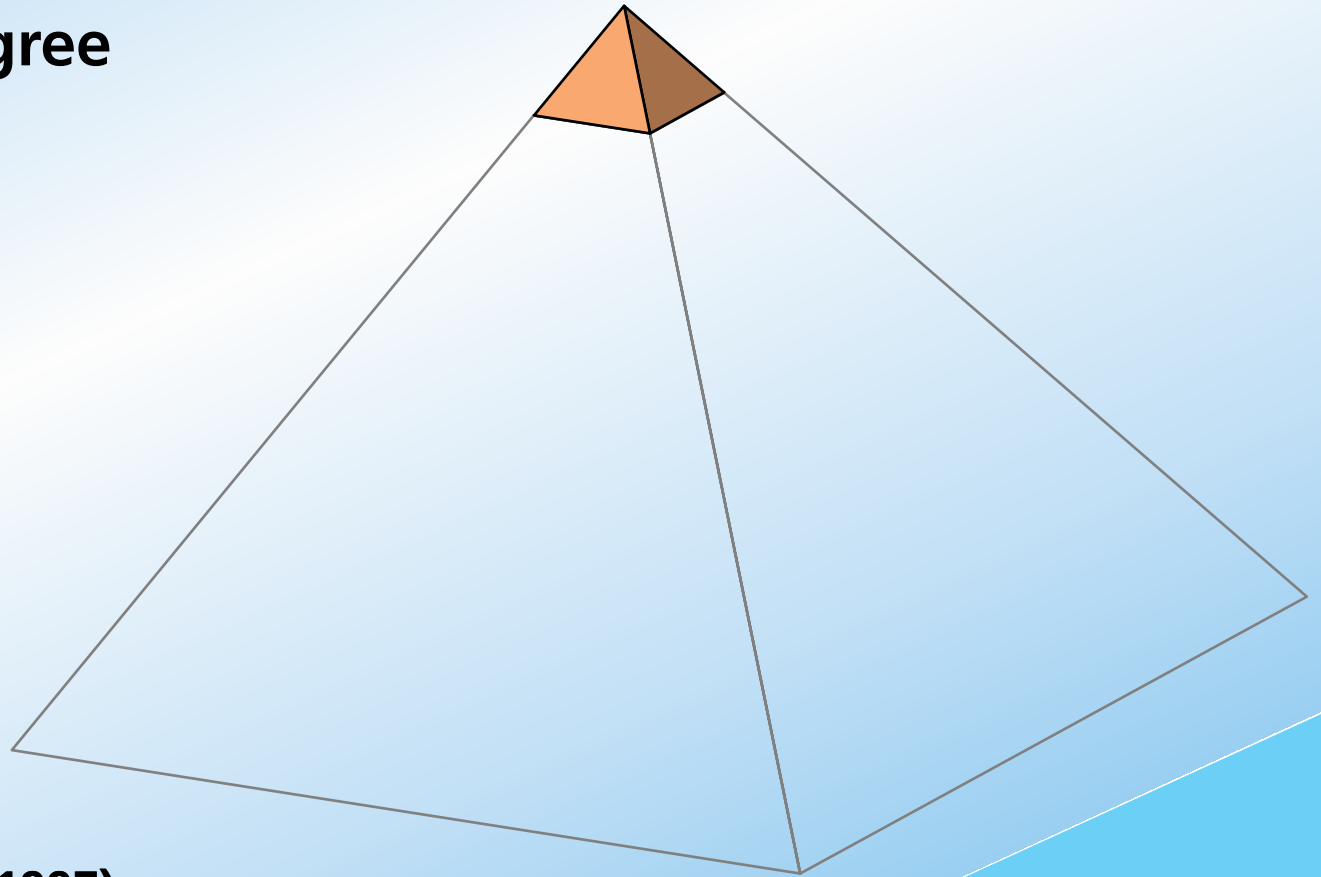
We have a problem

**about 1% of these get
a bachelor's degree
in physics**



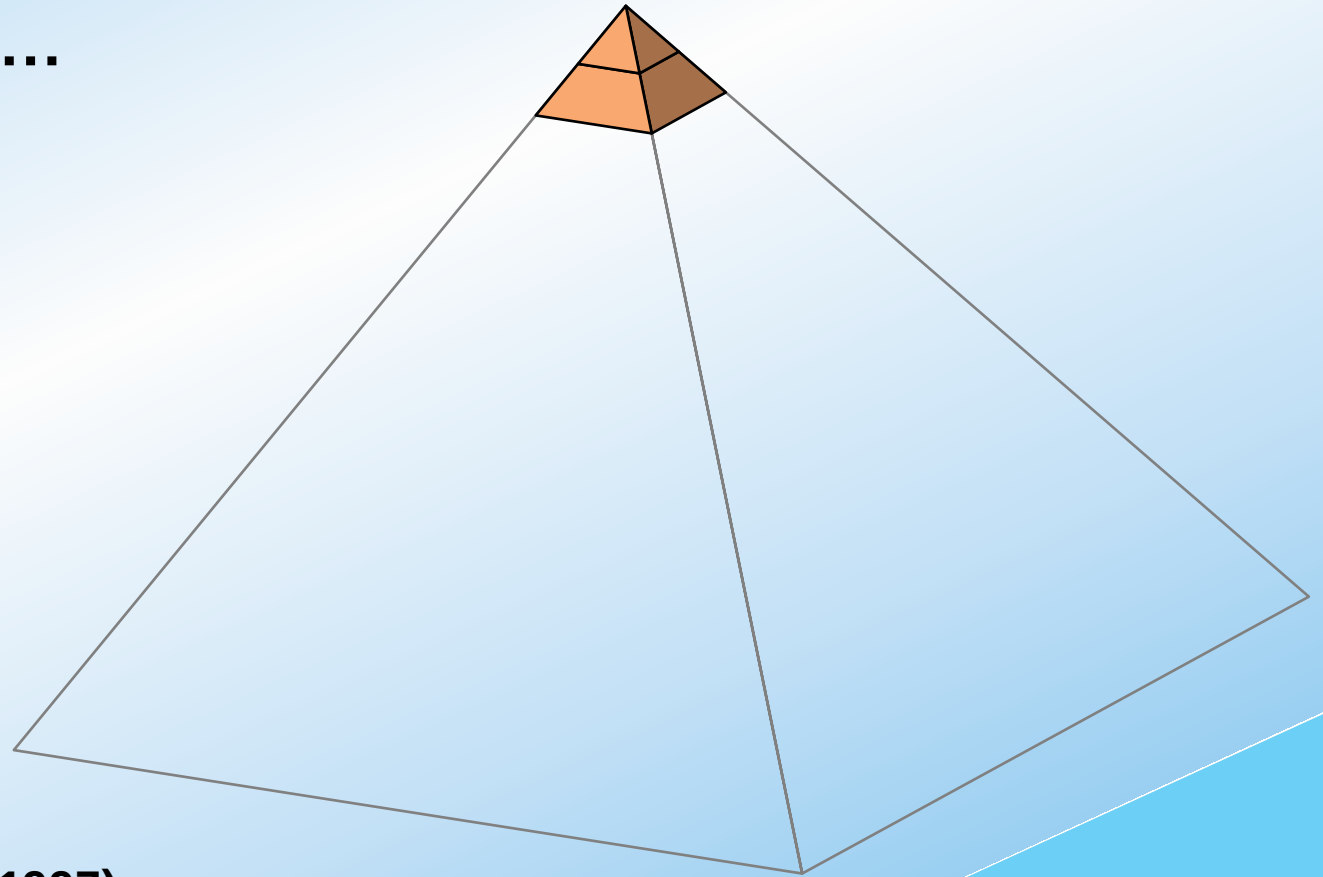
We have a problem

**Of the 4,300 students with
a bachelor's degree
in physics...**



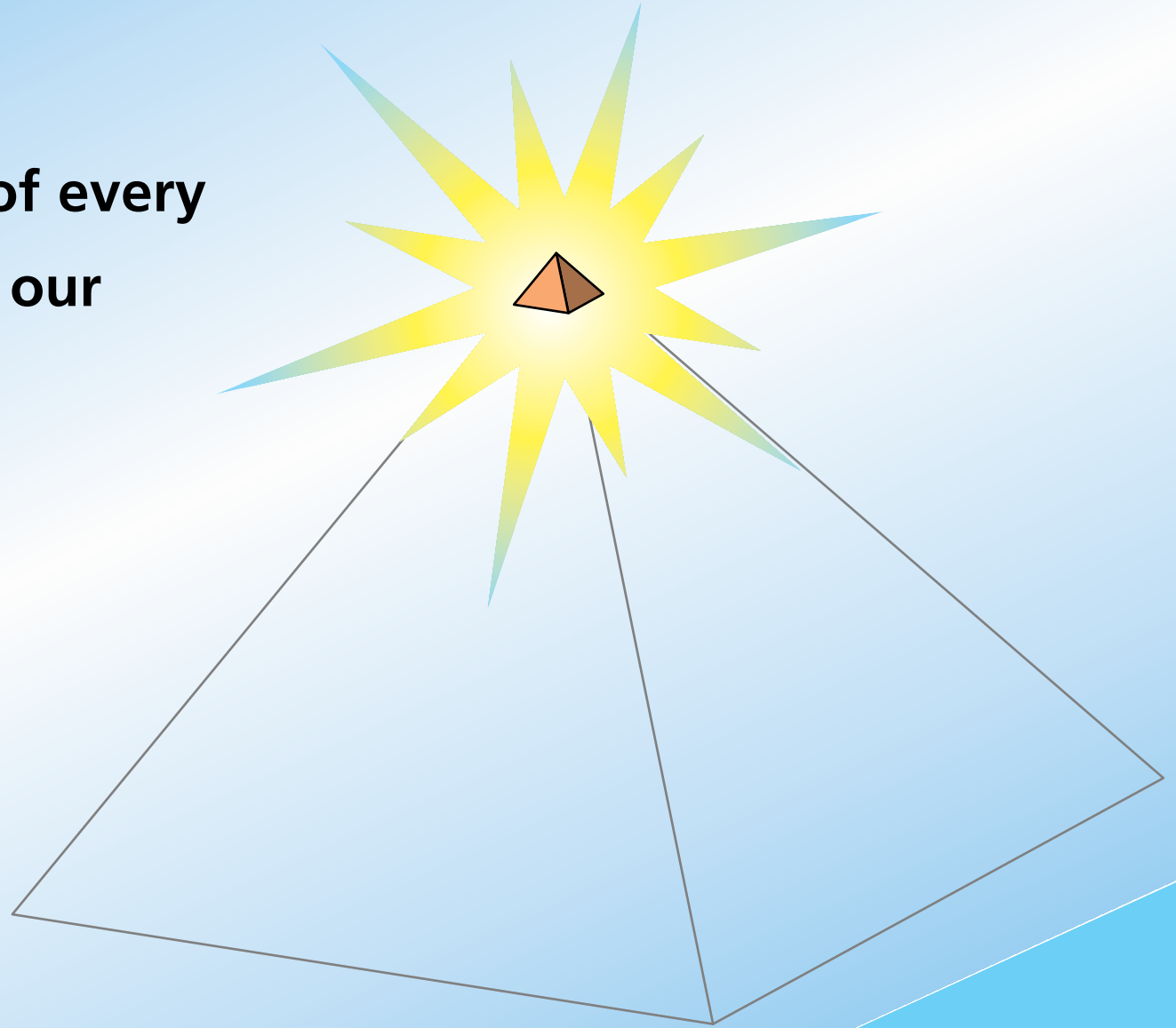
We have a problem

**about 35% go on to get a
Ph.D. in physics...**



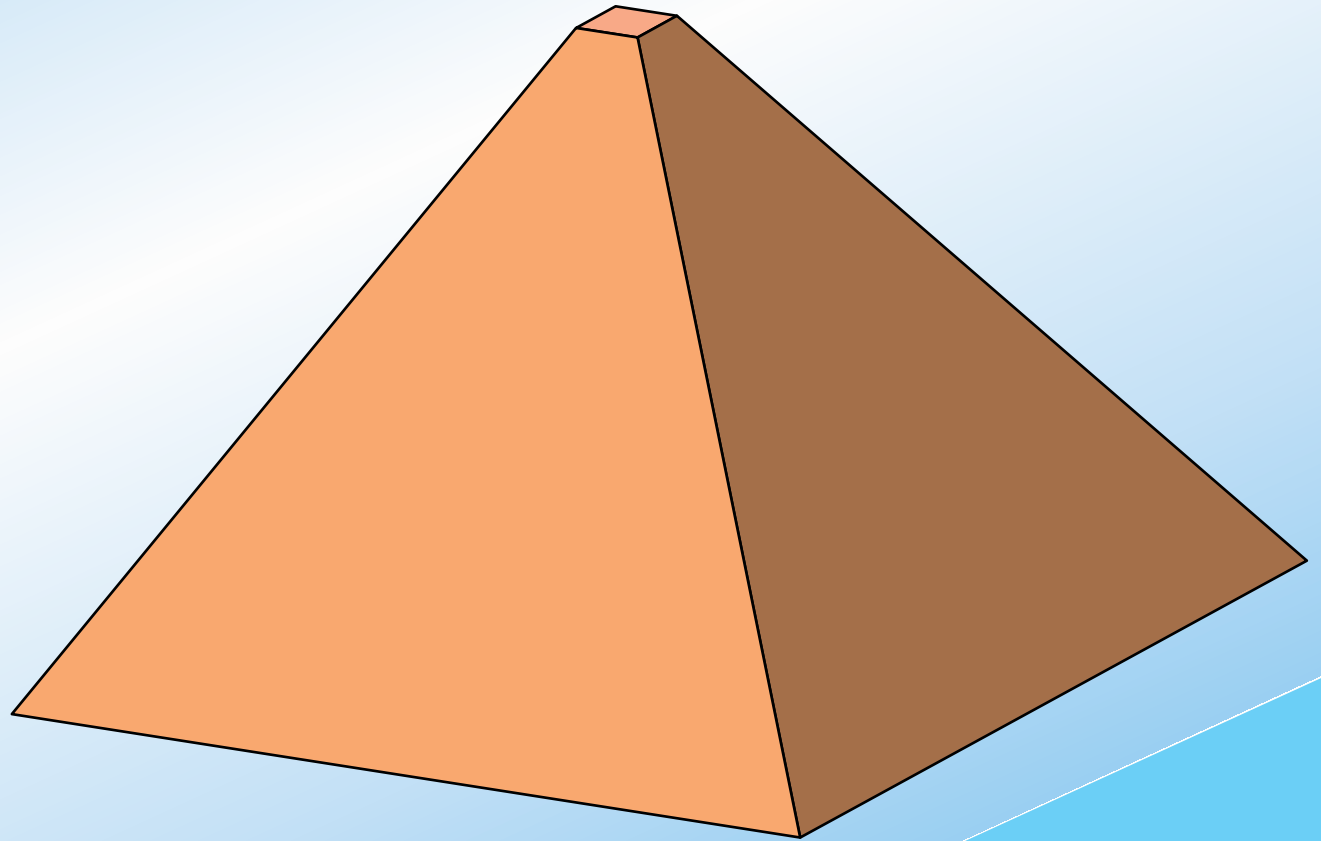
We have a problem

**That's one out of every
260 students in our
introductory
courses!**



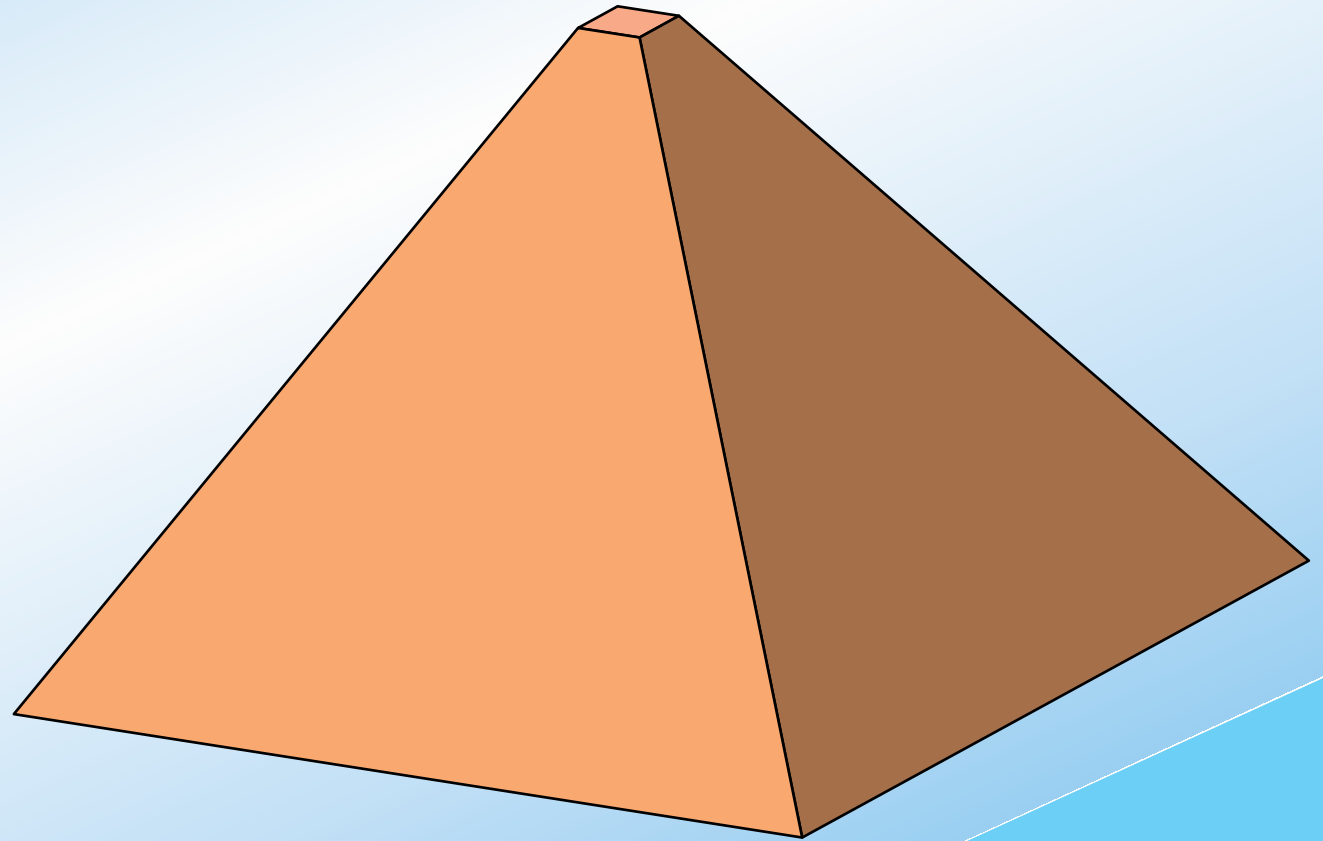
We have a problem

**What about the
other 259...?**



We have a problem

**What do we know
about these
students?**



We have a problem

They know the jargon:

- ▶ **circular motion**
- ▶ **barometric pressure**
- ▶ **light radius**
- ▶ **something to the power times ten to the something**

We have a problem

They are aware of their lack of knowledge

- ▶ **I graduated from college but I didn't study *astronomy***
- ▶ **It's been a while since I've had physics**

We have a problem

They are aware of their lack of knowledge

- ▶ **I graduated from college but I didn't study *astronomy***
- ▶ **It's been a while since I've had physics**

...and they don't care!

We have a problem

Should we worry?

We have a problem

We'd better!

We have a problem

"I took four years of science and four years of math...

**A waste of my time,
a waste of the teacher's time,
and a waste of space...**

**You know,
I took *physics*.**

For *what?*"





Why do we have this problem?

Why do we have this problem?

What are our three most important objectives?

Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**

Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**
- ▶ **excellence in teaching**

Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**
- ▶ **excellence in teaching**
- ▶ **education of graduate students**

Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**
- ▶ **excellence in teaching**
- ▶ **education of graduate students**
- ▶ **education of undergraduates**

Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**
- ▶ **excellence in teaching**
- ▶ **education of graduate students**
- ▶ **education of undergraduates**
- ▶ **education of non-majors**

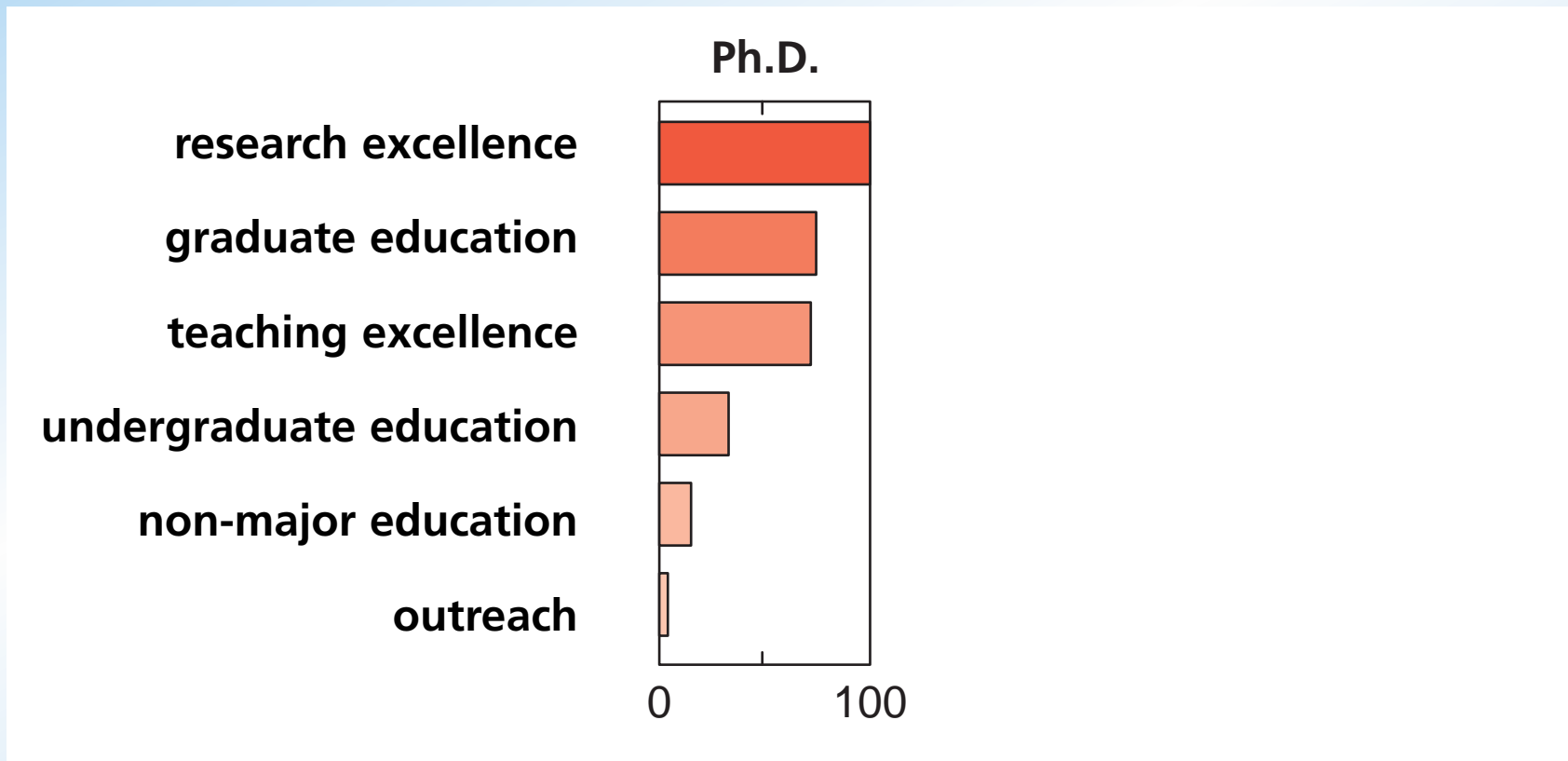
Why do we have this problem?

What are our three most important objectives?

- ▶ **excellence in research**
- ▶ **excellence in teaching**
- ▶ **education of graduate students**
- ▶ **education of undergraduates**
- ▶ **education of non-majors**
- ▶ **outreach**

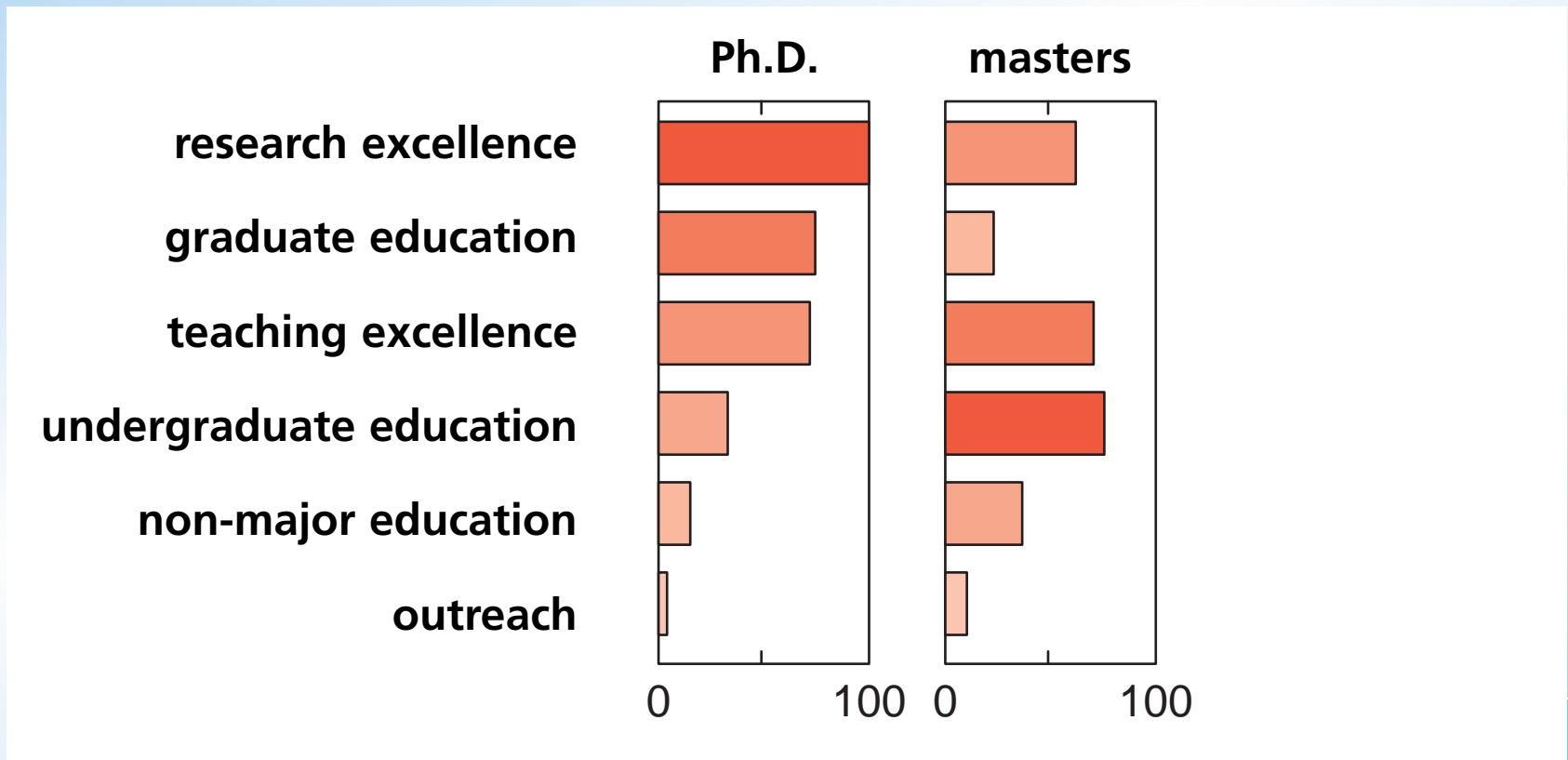
Why do we have this problem?

What are our three most important objectives?



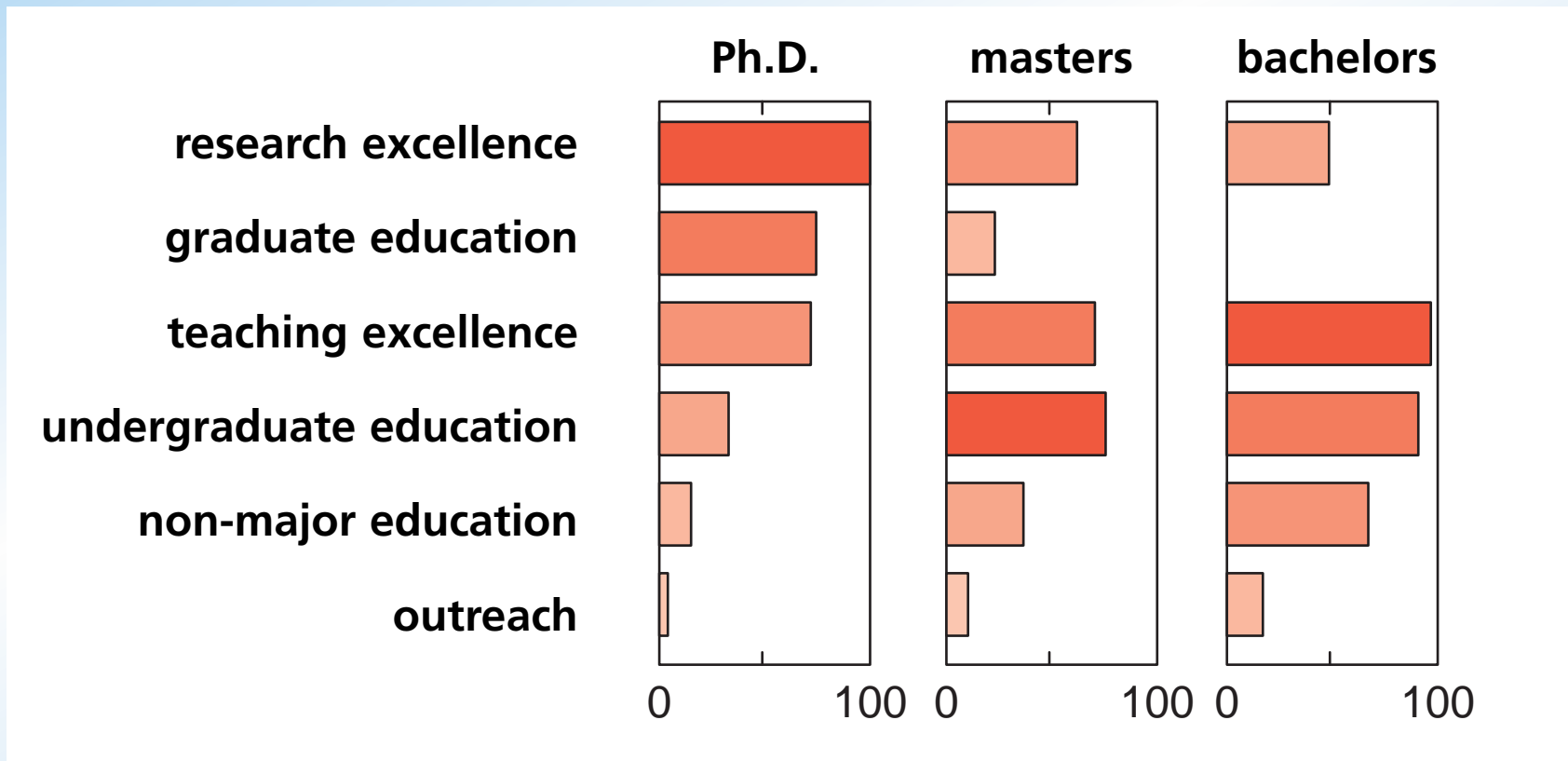
Why do we have this problem?

What are our three most important objectives?



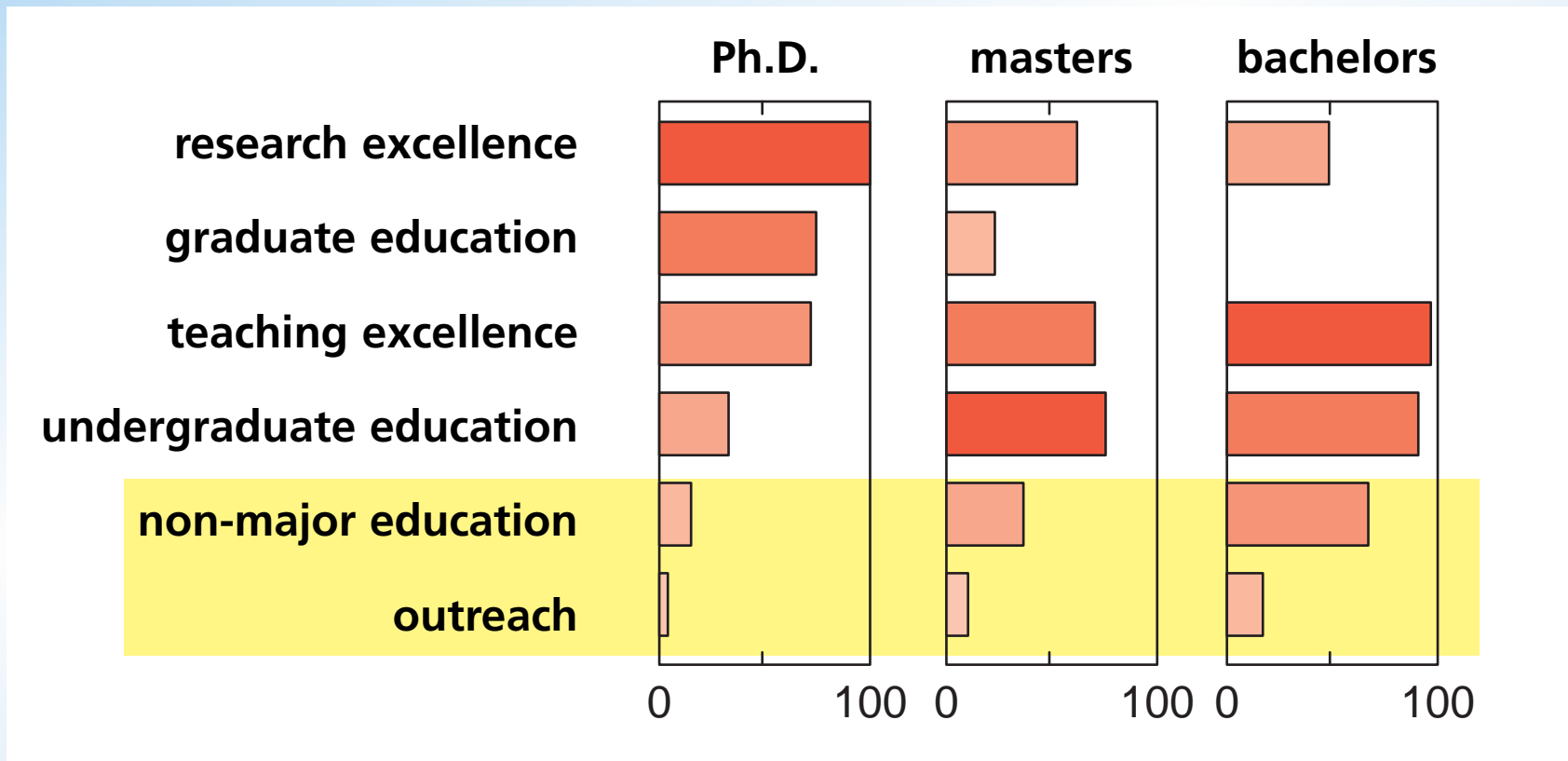
Why do we have this problem?

What are our three most important objectives?



Why do we have this problem?

What are our three most important objectives?

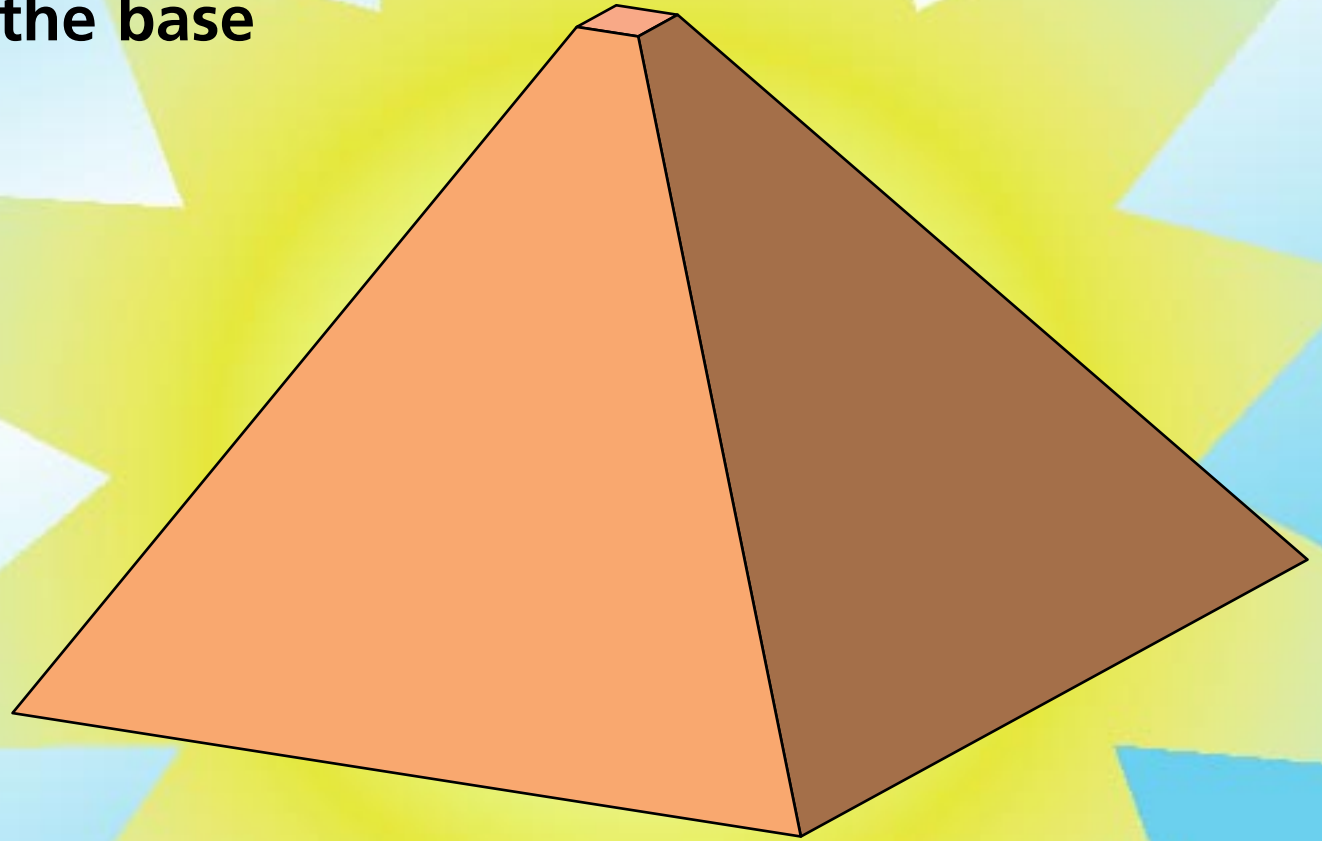


A wide-angle photograph of a large lecture hall. The room is filled with students seated at desks, viewed from behind. At the front of the room, a lecturer stands behind a podium on a stage. A large projection screen displays text and a silhouette of a person. The room has a curved wall and is dimly lit, with the main light source being the projection screen and stage lights.

So what should we do?

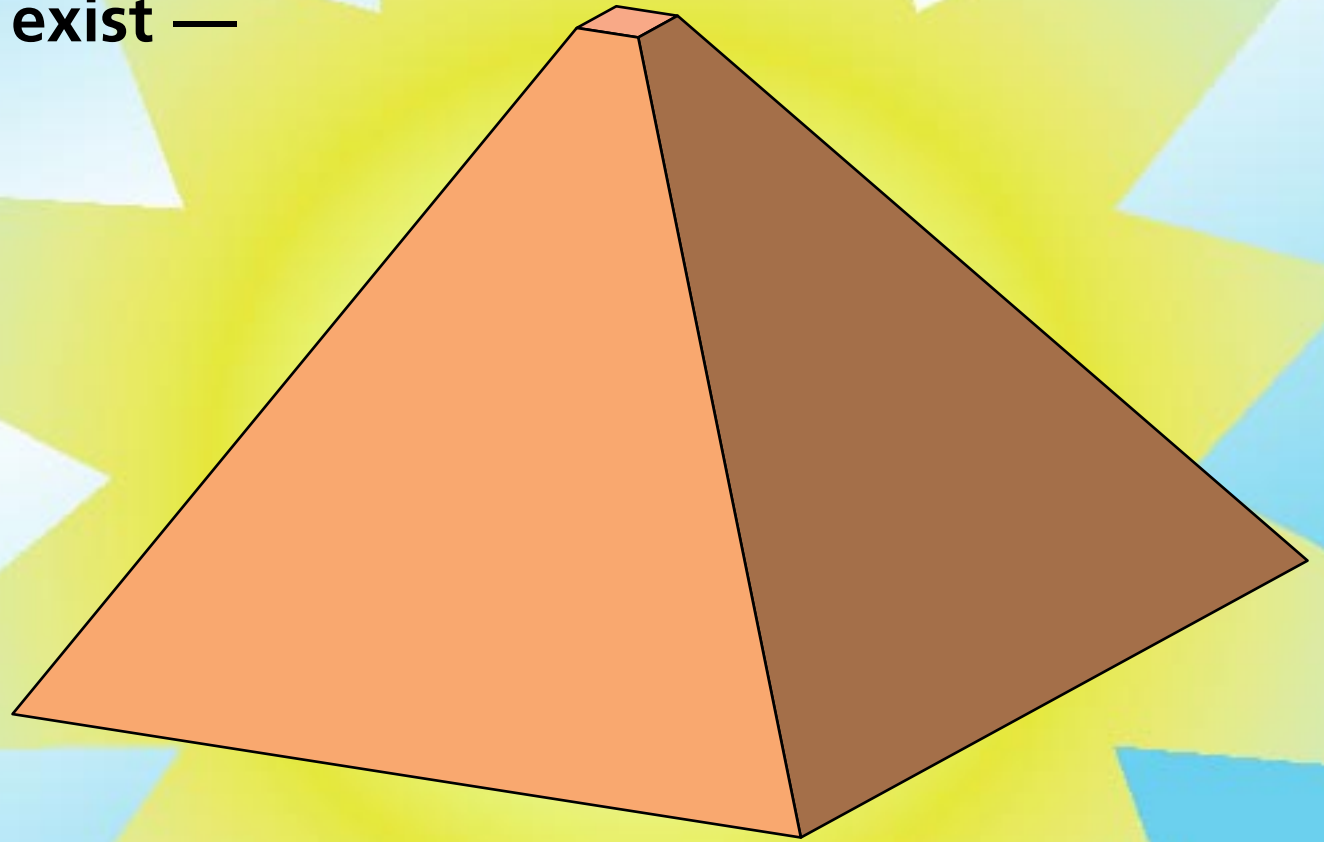
A path to the future

**Let's not forget the base
of the pyramid!**



A path to the future

**Good strategies exist —
let's implement
them!**



So what should we do?

Suggestions:

- ▶ **evaluate**
- ▶ **reach out to public**
- ▶ **don't (re)invent, *implement!***
- ▶ **community wide involvement**

So what should we do?

Challenges:

- ▶ **internal skepticism**

So what should we do?

Challenges:

- ▶ **internal skepticism**
- ▶ **growing pains**

So what should we do?

Challenges:

- ▶ **internal skepticism**
- ▶ **growing pains**
- ▶ **limited circle of influence**

Summary

- ▶ **Need: demonstrate value of physics**
- ▶ **Opportunity: education and outreach**
- ▶ **Strategy: discipline-wide collaboration**

Funding

National Science Foundation

**For a copy of this talk and
additional information:**

<http://mazur-www.harvard.edu>