

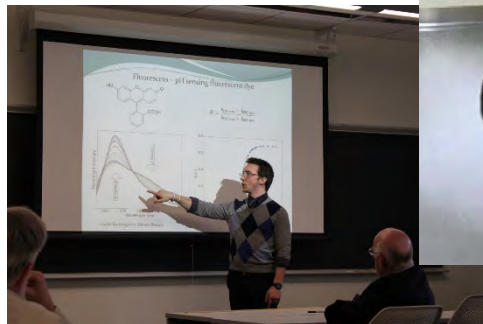
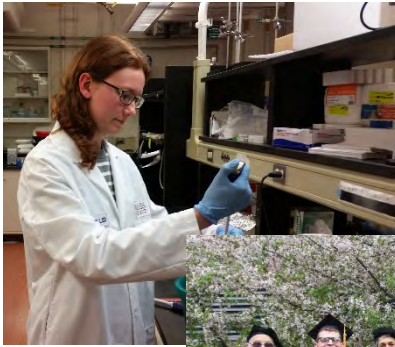
Physics @UMass



Slides by Prof. Tony Dinsmore, Physics Undergraduate Program Director

A complement to UMass Admissions info

Questions? Contact me at upd@physics.umass.edu



Outline:

A brief word about COVID-19 (my opinions)

I. Why major in physics?

- Nationwide, what do students do after graduating?

II. The Physics Department:

What does a physics major do at UMass?

- Courses
- Learning about career options
- Research
- Other programs: Dept. Honors and "iCons"

III. After graduation

Impact of COVID-19

These are my opinions -

UMass has acted **responsibly** (<https://www.umass.edu/coronavirus/>)

- Most students left on March 13, just before our spring break. They will not return this semester.
- Students who needed to were allowed to stay in the dorms.
- Most research labs are closed. Faculty are contributing to help the community and fight the virus.

UMass has also acted **compassionately**

- New, more relaxed rules about pass/fail options for the spring 2020 semester. Flexibility with deadlines.
- A lot of advising support

What we're doing now:

- Classes are taking place at scheduled times *via* remote delivery format, mostly using *Zoom*.
 - We have alternatives for students in other time zones or with limited internet access.
- Exams, papers, projects, etc. are proceeding. Students will earn the usual academic credit and progress toward degrees as originally planned.
- The physics department is innovative and collaborative. We have experimented with on-line supplemental activities for a long time. We are sending kits to students for their lab classes.

What will happen in the fall?

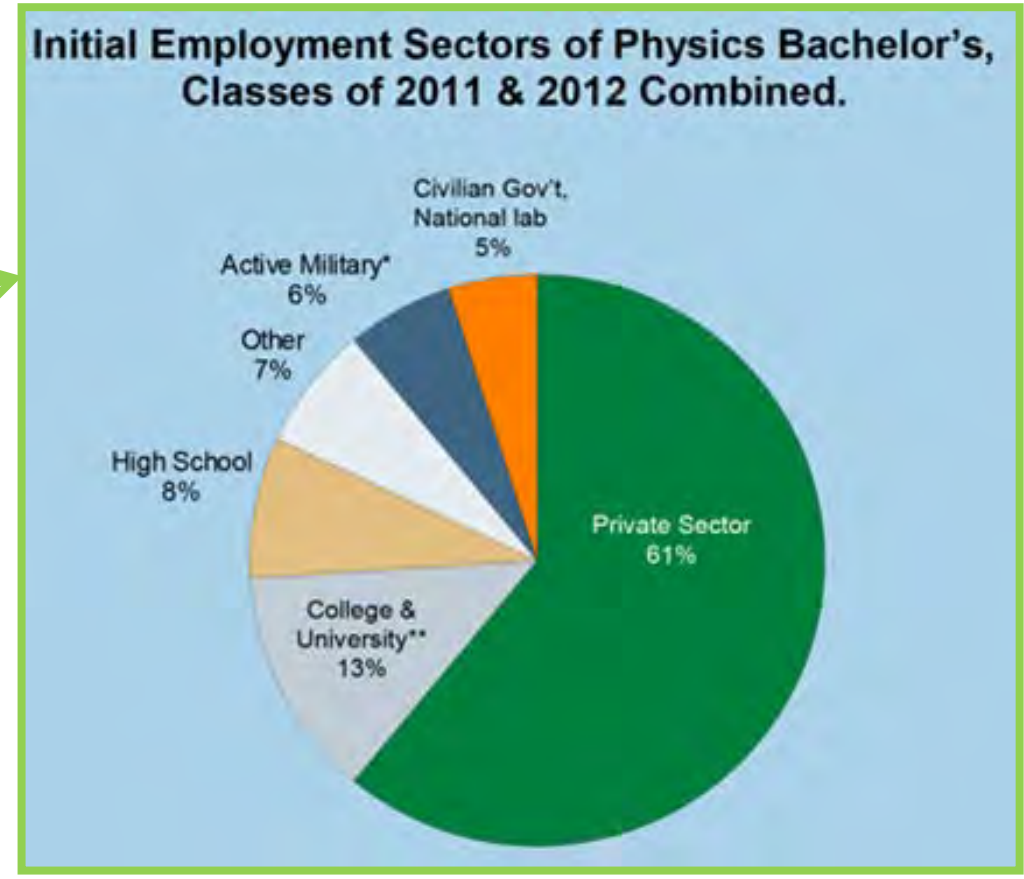
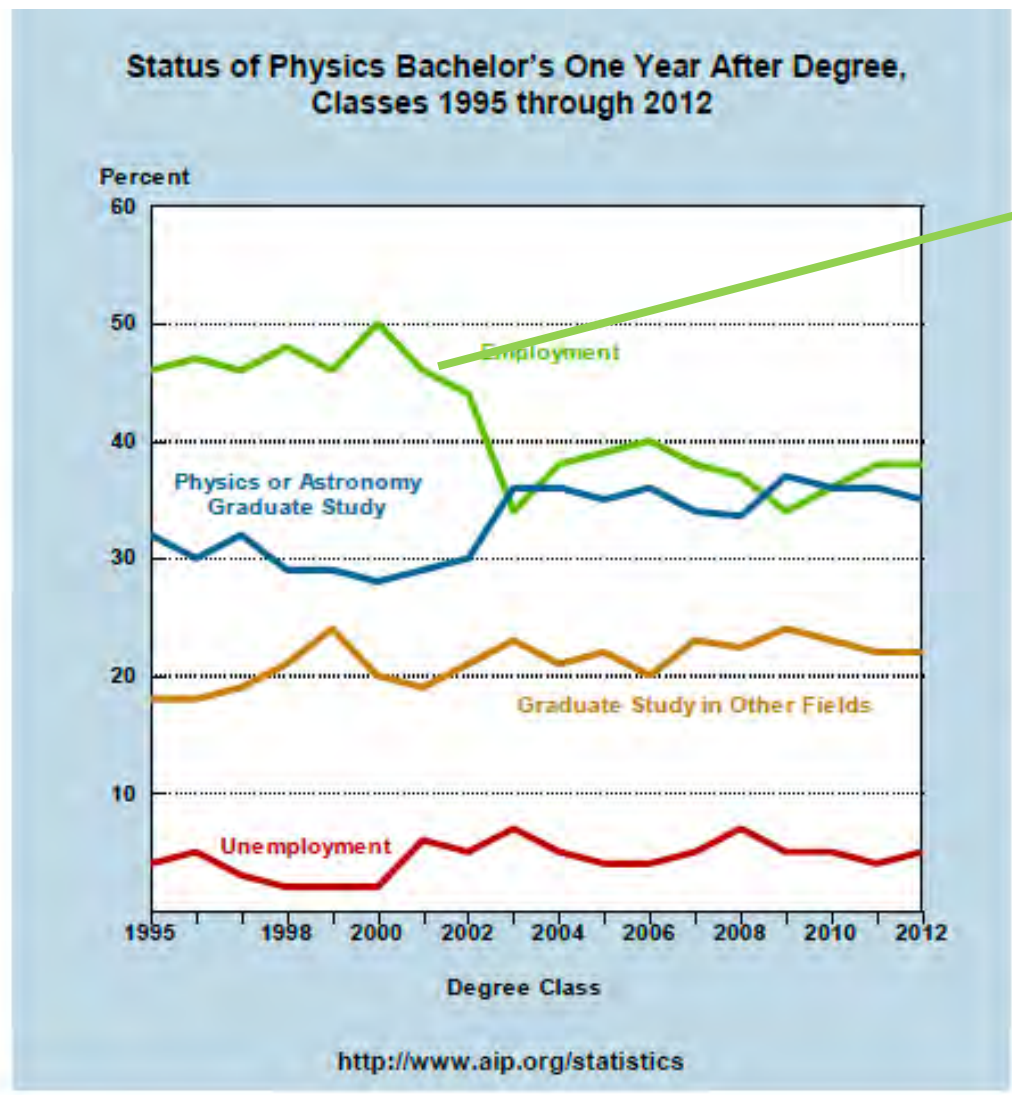
- I do not know. I trust the UMass administration: whatever the university does, we will make it work.

What skills will you obtain with your physics degree?

- A lot of physics & math
 - valuable for research in companies and national/gov't agency labs
 - valuable for teaching in schools
- Critical, analytical thinking
- Quantitative, mathematical modeling and data analysis
- Collaborating, working with teams
- Writing, communicating with various audiences



Outcomes: what physics majors did after graduating (U.S. avg.)



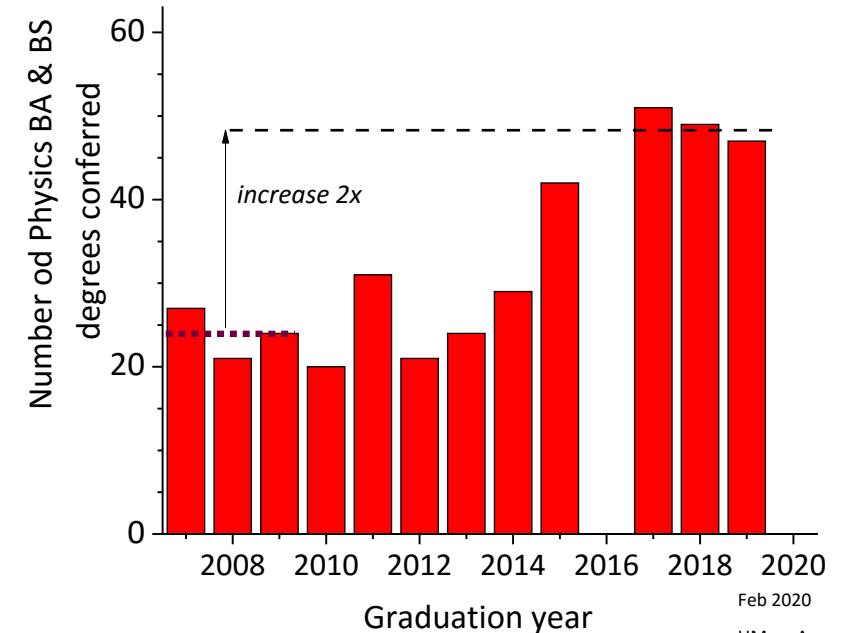
source: <http://www.aip.org/statistics>

Outcomes for UMass students are similar.



II. The Physics Department

- About 30 professors + 5 lecturers
 - A record of excellence and innovation in teaching & research
- About 260 undergraduate majors in all 4 years
 - Has been growing fast – a vote of confidence
 - About 15% from overseas.
 - *About 70% will do research while on campus*
- About 85 graduate students
 - Most are working toward PhD in Physics.
 - Teaching (in labs + grading), taking classes, doing research
- About 10 'postdoctoral fellows,' who do research



What does a Physics Major do at UMass?

(an outline for the rest of this presentation)

Standard components in any college:

- Core courses – expertise in the fundamentals of physics
- GenEd courses – breadth of knowledge (UMass requirement)

Less common components in and outside of our curriculum:

- Skills courses – writing, presenting, computing, data analysis, experiment design
- Learning about careers
- Research, teaching, outreaching, or other independent projects
 - Enormously helpful for choosing a future and for learning marketable skills
 - Consider these options too: Commonwealth Honors College and/or or Integrated concentration in Science (iCons)

Getting the most out of college:

- Get to know at least 1 professor every semester
 - Ask questions in class.
 - Talk to your professor after class.
 - Go to office hours, even if you just want to listen.

Core Physics Courses

All are taught by faculty. All academic advising is by faculty – same advisor for 4 years.

1st year Fall:

Physics 181* (Mechanics)
Physics 185 (colloq.– professional development)
Math 131** (Calc 1) or higher
GenEd and other

1st year Spring:

Physics 182* (E&M)
Math 132 (Calc 2) or higher
Intro to Measurement with Arduino (1 cr; optional)
GenEd and other

* Taught partially in team-based learning (TBL) format. Recommended even for those who earned 4 or 5 in Phys C AP

**Students who earned 4 or 5 on Calc AP exam should move ahead to the next math class.



Second year...

Fall: Thermo, waves & optics+lab (287,289)
Computational physics (281)

Spring: Modern physics+lab: intro to QM, relativity (284,286)
Techniques in theoretical physics (282)

3rd and 4th years:

“Professional Track:” 4 lectures + 1 lab + one advanced-topics

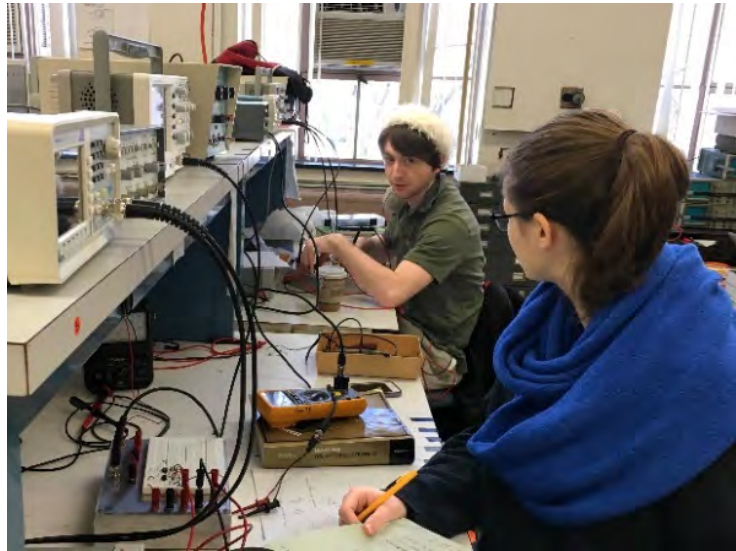
“Applied Track” (BS) for students with a strong interest in a specific sub-field of STEM. Replace some physics courses with electives.

“General Track” (BA): replace some physics with non-science electives. Works well for K-12 teacher training.

Lab courses

- Each of the first four semesters
- One more in junior or senior year (IIlab)
- Optional additional lab courses

Renovated
teaching labs in
Hasbrouck



'Skills' courses

- Freshman colloquium (Phys185)
 - Introduction to the major and the discipline of physics
- Introduction to Measurement using Arduino (2nd semester; optional)
- Computational Physics (3rd semester)
- Math methods (4th semester)
- Writing in Physics (5th semester) – resumes, abstracts, proposals
- Jr/Sr lab class
 - read articles, plan experiments, present plans and results, write manuscripts
- 500-level classes with emphasis on practical skills:
 - Electronics, optics, data analysis, and field-specific courses
- Teaching physics (optional)
 - Training in pedagogy, practice as teaching assistant and/or lecturer
(upper-class physics majors are part of the teaching team in Physics 181-182)



University GenEds for physics majors

1. College Writing EngWrt 112
2. Basic Math, Physical science (no problem!)
3. One biological science, 4 credits (BS)
4. Four social world GenEd's, (4 credits each): among literature, arts, historical studies, and social & behavioral sciences.
Of these, one course with US diversity (DU), and one course with Global diversity (DG). The DU or DG must be taken in your first year.
5. Junior year integrative experience (I.E.), satisfied by taking Physics 440, the Intermediate Lab course.
6. Writing in physics (jr. yr.)
7. If you're on the B.A. track, a foreign language is required

Learning about careers

Start exploring options early

Curriculum includes valuable items for resume

- For a wide range of interests:
 - Support for internship & job applications
 - “Physicists in Industry” seminar series
 - Funds for travel (department funds) and for summer research (Chang & Langley Endowments)
 - Myriad research opportunities
 - Support for teacher-training
 - Professional development classes in 1st and 3rd years
- For graduate school, toward PhD:
 - Workshops for GRE and application prep

Physicists in Industry Seminar Series

Olivia Comeau UMass alumna

MassMutual

Physics to data Science:
My Not-So-Predictable Journey



Physicists in Industry Seminar Series

Kazem Edmond

UMass alumnus

ExxonMobil

A soft matter physicist's journey from
academic to corporate research.



Physicists in Industry Seminar Series

Alexander Moschella

UMass BS in Physics, 2018

SRC, Inc

Alexander Moschella will
discuss his experience in
finding an engineering posi-
tion as a physics major, and
will share information
about career opportunities
at SRC.



Finding internships, summer jobs, etc.

College of Natural Sciences
Department of Physics

Resources | Jobs | Giving

Research | Academics | Graduate | **Undergraduate** | Directory

Undergraduate Program in Physics

Physics Major or Minor

If you are considering a major or minor in physics, please start with the [Physics Majors Handbook](#). The Physics Majors Handbook is your definitive source of information about the requirements and options for pursuing a bachelor's degree in physics. It includes information about honors degrees and the physics minor. There you will also find **checklists of requirements** for the various degree tracks. You can also find the checklists here for the [Professional track \(rev 11/2019\)](#) (new format with additional info!), the [Applied track](#), and the [General track](#).

You can declare a physics major or minor (or just talk to someone about the possibility) by first meeting with

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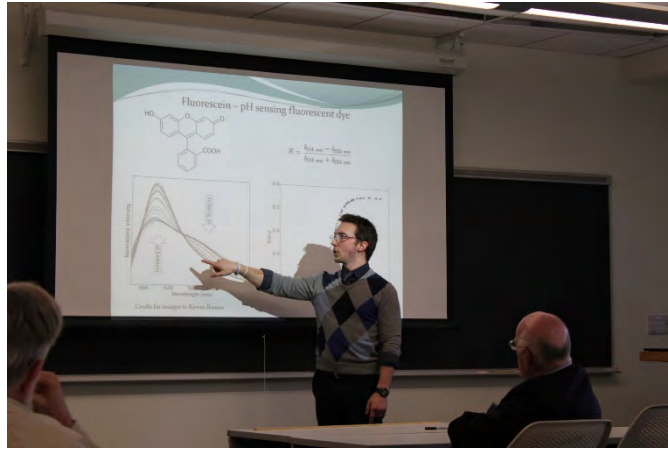
Other Opportunities: Research, Teaching, and Student Organizations

Undergraduate Physics majors are strongly encouraged to participate in many aspects of the Department beyond taking courses. We are a major research center, and our faculty engage in research in a wide variety of cutting-edge topics. We encourage and welcome undergraduates to participate in this endeavor. It's an excellent experience for students, whether headed for research-related careers or not. A partial list of open research positions, as well as a list of previous research projects, can be found under **Undergraduate Student Research**. Here is a [Guide to finding on-campus research positions](#). (It's quite different from signing up for classes.) Physics majors also get paid internships with companies, national labs, or other universities over the summer: see this [Guide to finding off-campus research positions & internships](#). Additionally, teaching assistantships are sometimes available to undergraduates. A list of teaching opportunities can be found at the [Jobs link](#) for the department, especially just before or after the start of each semester. Finally, a number of physics related science clubs and programs may be of interest to majors; these are listed under **Related Programs and Organizations** in the right sidebar.

Undergraduate

- Program Overview
- Handbook for Majors
- Advisors
- Undergrad Research
- Undergrad Assistantships
- Undergrad Scholarships
- Awards

Student research



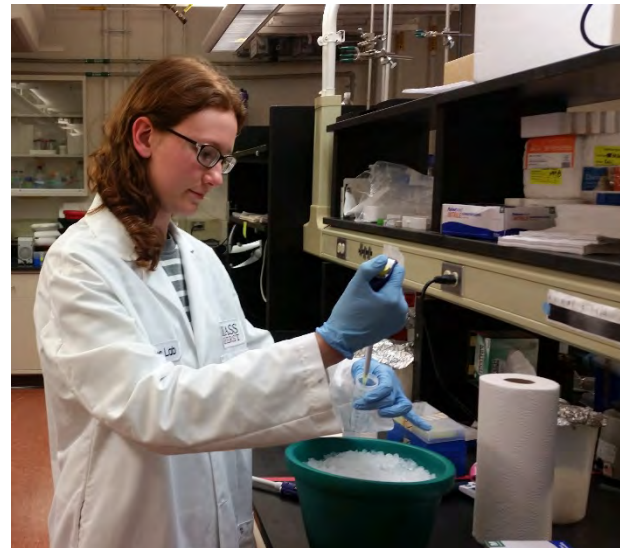
Trevor



Guangfeng



Sean and Christian



Julianne

World-class research on campus

Individual-faculty-led groups:

- Approx. 30 faculty
- A wide range of topics
- Physics students also work in astronomy, math, polymer science & engineering, chemistry, engineering. For academic credit or pay (e.g. over summer)

The new Physical Sciences Building



Research Centers: collaborations



Getting involved in independent projects: research, teaching, and/or outreach

Why?

- Not like a lab class (independent; exploring the unknown).
- Learning how to do science: different from coursework.
- Inspiring; excellent preparation for job or grad school.
- 70% of physics majors work in a lab on campus.

How?

- Talk to a Professor, join a group.
 - Part-time during semester (credit); summer (\$); off campus.
- join *iCons*
- pursue Departmental Honors in Physics
- Work as teaching assistant

Other Extra-curricular activities:

- Society for Physics Students (weekly meetings with pizza)
- Science Outreach club, Astronomy Club,
- Conference for Undergraduate Women in Physics (CUWiP)
(Large annual event. We hosted it in Jan., 2019)

Commonwealth Honors College *and* Departmental Honors in Physics

Why? *Access to smaller, more focused courses. Distinction.
Eligibility for research or stipend \$.*

How? CHC admission is based on GPA (≥ 3.4)
-Admissions opens twice per year.

Two tracks:

- Honors in General Studies: Taking 4 Honors Gen-Ed courses + IE
and/or
- Departmental honors:
 - i) Two, 1-credit “honors colloquia.” At least one at ≥ 300 level.
Smaller class meetings
 - ii) 1-year **Capstone (sr. thesis).**
Excellent training toward many future paths

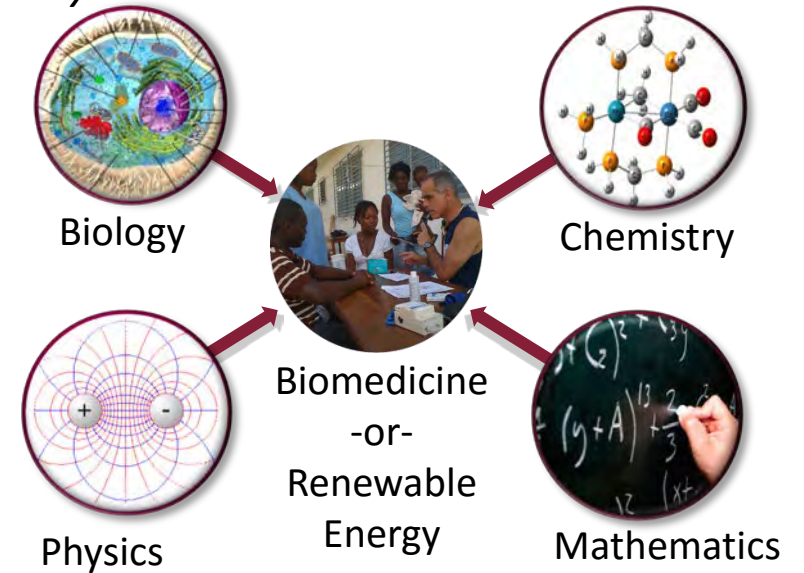


Integrated Concentration in Science (*iCons*)

<https://icons.cns.umass.edu/>

Mission: To produce the next generation of leaders in science and technology with the attitudes, knowledge, and skills needed to solve the inherently multi-faceted problems facing our world.

- 4-year concentration program (18 cr.), unique to UMass
- *Renewable energy or biomedicine*: Areas of real-world need
- Interdisciplinary teamwork
- Student-led work (faculty as resource and coach)
- Very successful training program



Examples from physics:



“Simulating performance of a nuclear physics detector” (Mitch Negus)



“Why are some countries better than others at switching to renewable energy sources?” (Dana Brown)



Experiments: “Measuring Polymer Properties for Waste Heat Recapture” (Joshua Bostwick)”

III. After graduation

- At UMass, about 1/3 - 1/2 of physics majors go on to PhD. We help students prepare applications. We have ~ 85 PhD-earning students in Physics at UMass.
- **Graduate students in PhD program are paid for teaching or research – they don't pay tuition**
 - 1st year: take classes, teach part-time.
 - 2nd year: some classes, start research.
 - 3rd year onward: full-time, independent research.
(discover new science, write articles, attend conferences; ***be a professional physicist***)
- Roughly 1/2 - 2/3 of students go elsewhere. We have an excellent Career Center (<https://www.cns.umass.edu/advising/cns-career-center>)

Jobs:

- Teaching K-12 (most often HS)
- R&D: national & agency labs (various), companies (Belcan Engineering, KAYAK, Liquidia, Mass. General Hospital, Qnect, Raytheon, Rigetti Computing, JEOL, NV5,...)
- Data analytics: MassMutual, etc.
- **Grad/professional programs** outside science: Law or Medical Schl

