

Influence of Graduate Curriculum on Undergraduate Education

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Bachelor's Degrees in Physics in 2000

- US: 3,770 total, 21% awarded to women (4,553 total in 2003) – population 298.4 million
- UK: 1,755 total, 21% awarded to women – population 60.6 million
- France: 3,256 total, 33% awarded to women – population 60.9 million

(AIP statistics)

US physics bachelor's degree statistics for class of 2003

Total number of degrees: 4,553

Women – 21%

4,288 US citizens:

- African-American – 4%
- Hispanic-American – 3%
 - White – 87%
- Asian-American – 4%
 - Other – 3%

1st year graduate school enrollments in Physics for 2003

- 3,168 students entering physics departments in fall of 2003
- 46% (1,457) of entering students were foreign students
- 21% of entering students were women

Bachelor's degrees awarded in 2002

	Number
Psychology	~75,000
Engineering	73,964
Biological/Life Sciences	60,256
Computer & Information Sciences	47,299
Mathematics	12,395
Chemistry	9,136
Physics	4,305
Geosciences	3,974

Course Requirements and Undergraduate Degree Programs (Percentages)

SPIN-UP statistics

Required Course	Bachelor of Science	Bachelor of Arts	Other Bachelor	All Programs
Introductory classical physics	99	99	97	99
Intermediate classical mechanics	97	88	87	95
Introductory modern physics	95	94	94	95
Intermediate electromagnetism	96	88	81	94
Advanced laboratory courses	90	74	90	87
Quantum mechanics	88	74	65	84
Thermal and/or statistical physics	82	57	81	78
Mathematical physics	45	38	36	43
Optics	46	24	52	42
Other physics courses	85	82	87	84
Number of survey respondents	387	92	31	510

Required courses as a percent of total physics credits required in a standard degree program

SPIN-UP statistics

Required Course	Bachelor of Science	Bachelor of Arts	Other Bachelor
Introductory classical physics	22	24	26
Advanced laboratory courses	12	13	14
Intermediate electromagnetism	11	11	10
Introductory modern physics	10	12	11
Intermediate classical mechanics	10	11	10
Quantum mechanics	10	11	8
Mathematical physics	8	11	9
Thermal and/or statistical physics	8	10	9
Optics	8	10	9
Other physics courses	18	20	19
Number of survey respondents	380	91	30

Sample UG Physics Curriculum

	First Semester	Second Semester
First Year	<ul style="list-style-type: none">•Calculus-based Intro Physics I•Calculus I	<ul style="list-style-type: none">•Calculus-based Intro Physics II•Calculus II
Second Year	<ul style="list-style-type: none">•Intermediate Classical Mechanics•Calculus III•Linear Algebra	<ul style="list-style-type: none">•Modern Physics•Applied Electronics•Differential Equations
Third Year	<ul style="list-style-type: none">•Quantum Mechanics•Electricity & Magnetism I•Junior Laboratory	<ul style="list-style-type: none">•Electives in Physics•Junior Laboratory
Fourth Year	<ul style="list-style-type: none">•Advanced Classical Mechanics•Thermodynamics & Statistical Mechanics•Science Elective	<ul style="list-style-type: none">•Electives in Physics

Typical Physics Electives

- Optics
 - Astrophysics
 - Condensed Matter
- Electricity & Magnetism II
 - Mathematical Physics
 - Quantum Mechanics II
- Particle or Nuclear Physics

Institutional Differences

- BA vs. BS

BS typically requires 14-16 courses in the major and permits greater specialization

BA typically requires 8-10 courses in the major and allows students to supplement and further broaden the educational experience with courses beyond the major

Institutional Differences

- Variety of courses

The larger the institution, often the more variety of courses (even at the UG level) that are offered

- Level of courses

Most foundational courses are taught at the same level universally; some topics at upper level may vary

- Enrollments in courses
- Undergraduate research opportunities

Thoughts on the status of the UG curriculum

- Physics is a hierarchical subject
- Physics graduate programs and GRE influences curriculum
- Many of the curriculums in place across the US prepare students adequately for graduate school
- Curriculum hasn't changed much in 50+ years
- Few curriculums allow multiple entry ways or have a variety of pathways which allow for careers other than those requiring graduate degree

What's Up?

- Where do our undergraduate physics majors go after graduation?
- Are we training leaders for the future who are technologically savvy, can think critically, and exist in a global economy?
- Are we training enough new high school physics teachers?
- Why can't we graduate 75,000 physics bachelor's degrees? Should we?

Unique Physics Curriculums

- Physics with biomedical concentration
- Physics with business or management (UWisc LX, UWisc M, TCU, Cal State Fullerton)
- Five year Financial Markets and Trading Program (IIT)
- Applied physics
- Other interdisciplinary degrees

Final Thoughts

- Get better idea of standard physics curriculum – 4 year colleges, Ph.D. producing universities, and major M.S. producing universities
- Review and create other physics degree options beyond traditional B.S. degree
- Find ways (like chairs conference) for us to discuss the physics curriculum and ways to improve it