

## Physics Undergraduate Degrees at the University of Washington

As we embark on a discussion of possible changes in our undergraduate major curriculum it is presumably helpful to understand how our current curriculum works. The following is an effort to characterize the participation of our current students in our current courses. I have studied the academic careers of a cohort of 360 students who received a BS in physics during the years 1997 to 2005 (about 45 per year) and received a passing grade ( $\geq 2.0$ ) in Phys 228. [There were approximately another 40 degrees awarded during this period to those who did not pass 228 and who, presumably, took a 228 like course elsewhere or were excused from the 2.0 grade requirement.] The corresponding student numbers suggest UW entry from 1976 until 2003. All participation numbers below are percentages of this 360 student cohort and correspond to grades of 2.0 or above.

Intro courses: About 71% of these students took the 12X sequence at the UW with grades at 2.0 and above. Most of the rest presumably are transfer students (although a few ( $< 1\%$ ) seemed to have taken 12X with grades below 2.0. About 1% of the cohort participated in the 11X sequence.

- Phys 12X 71%

200 Level courses: About 95% of these students passed Phys 227 with a grade at or above 2.0 (the rest presumably are transfers or received grades below 2.0). 92% of these students received grades of 2.0 or above in Phys 224 (Thermal) and 225 (Modern). Thus the vast majority ( $> 90\%$ ) of these students passed our required 200 level courses. (I presume the other small fraction is largely transfer students.) About 11% took the optional Phys 231 (Intro to Exp Phys) course and 15% took Phys 232 (Intro to Computational Phys).

- Phys 227 95%
- Phys 224 92%
- Phys 225 92%
- Phys 231 11% (opt)
- Phys 232 15% (opt)

300 Level Courses: As expected 98% of these students took the required EM sequence Phys 321 & 322 (the other 2% are a mystery – transfers?), while 59% took the optional third quarter, Phys 323. The fine structure for this 98% is that 85% took Phys 321 within 1 year (4 quarters) of taking Phys 228 (the expected schedule), 5% took it more than 1 year later (up to 10 quarters later), and 8% took Phys 321 before successfully completing Phys 228. A similar 97% took the required Phys 334

(Circuits) lab course. Of the Adv Modern Phys options 17% took Phys 315 (Applied Modern Phys) and 83% took Phys 324 (QM I). 54% also took the second quarter of QM, Phys 325. Majors are also required to take 2 of the advanced lab courses. Of the 300 labs 79% took Phys 335 (Circuits II) and 45% took Phys 331 (Optics). Of the optional 300 level courses 25% took Phys 328 (Stat Phys), and 19% took Phys 311 (Rel & Grav). In summary, our majors are essentially all taking the required courses and slightly more than 50% take more than is required. [Recall that students must take 5 credits in physics or cognate fields beyond the required courses.]

- Phys 321, 322 98%
- Phys 323 59% (opt)
- Phys 315 17%
- Phys 324 83%
- Phys 325 54% (opt)
- Phys 331 45%
- Phys 334 79%
- Phys 311 19% (opt)
- Phys 328 25% (opt)

400 Level Courses: At this level there are few general requirements except fulfilling the lab requirement and the 3 credit research or seminar requirement. Of the 400 level labs 31% took Phys 431 (CM), 27% took Phys 432 (Atomic & Molecular), 13% took Phys 433 (Nucl & Part) and 31% took Phys 434 (Computers in Measurement). Thus the total laboratory participation in 300 and 400 level labs is 226%, where the minimum would be 200%. Hence about  $\frac{1}{4}$  of our students take more than the required number of labs (assuming this is not due to a single student taking many labs). In the 400 level modern physics courses 15% of the students took Phys 421 (Atomic & Molecular), 16% took Phys 422 (Nucl & Part) and 13% took Phys 423 (Solid State). Of the other 400 lecture courses we offer participation was 24% in Phys 424 (Math Phys/ Class Mech), 4% in Phys 427 (Appl of Phys), 7% in Phys 428 (Sel Topics – last Bio Phys), 1% in Phys 436 (Nonlin Dyn, 2 students in 1997), 7% in Phys 441 (Quantum Phys). For the research/seminar credits about 50% took Phys 401,2,3 (Independent Study) in each quarter, 15% took Phys 485,6,7 (Senior Honors Seminar) in each quarter, 3% took Phys 491,2,3 (Independent Research) in each quarter and 7% took Phys 494,5,6 (Current prob seminar) in each quarter. (I have not studied the correlations between quarters or the actual number of credits taken.)

- Phys 431 31%
- Phys 432 27%
- Phys 433 13%
- Phys 434 31%

- Phys 421 15%
- Phys 422 16%
- Phys 423 13%
- Phys 424 24%
- Phys 427 4%
- Phys 428 7%
- Phys 436 1%
- Phys 441 7%
- Phys 401,2,3 ~ 50%
- Phys 485,6,7 ~ 15%
- Phys 491,2,3 ~ 3%
- Phys 494,5,6 ~ 7%

The big picture is that approximately 1/3 of our undergraduate majors take the bare minimum of courses required (primarily 200 and 300 level). This is consistent with the fact that 34% of the degrees in the cohort discussed above were awarded within 4 quarters of passing Phys 228. These students are active in the Department for 2 years or less (1 year or less after Phys 228). The other 2/3 of the cohort is more actively engaged in our curriculum. Approximately 45% of the cohort received their degree between 1 and 2 years after completing Phys 228 (2 to 3 years in the Department), *i.e.*, according to our nominal schedule. The UW careers of the remaining 21% stretched out to 8 years (5% > 3 years) after Phys 228 (presumably students with close to full time employment). [I have made one attempt to check if these 3 cohorts, based on time from Phys 228 to degree, are distinct. The average Phys 228 grade for the first group, 1 year or less, is 2.8. The average 228 grade for the 1 to 2 years group is 3.2, while the average grade for the more than 2 years group is 3.3.] I would crudely characterize our majors as composed of a 33% cohort with a primary interest in obtaining a degree as quickly as possible, with the minimum number of courses, a 20% cohort with a very serious interest in physics (and, perhaps, graduate school), and the rest falling somewhere in between.

Steve Ellis  
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Table:

Level

100

12X  
71%

200

Required	224 95%	225 92%	227 95%	228 100%
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Optional

231 11%	232 15%
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300

Required	321/322 98%	315 17%	or	324 83%	331 45%	334 79%
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Optional

323 59%	311 19%	325 54%	328 25%
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400

Labs	431 31%	432 27%	433 13%	434 31%
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Adv Mod

421 15%	422 16%	423 13%
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Other

424 24%	427 4%	428 7%	436 1%	441 7%
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Res/Sem

401,2,3 ~ 50%	485,6,7 ~ 15%	491,2,3 ~ 3%	494,5,6 ~ 7%
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