# Transcript: 2022 Physics Admitted Students: Details

## Slide 1: Additional Details

Hello. I'm Marjorie Olmstead, the Associate Chair for Undergraduate Affairs and the Undergraduate Faculty Advisor in physics at the University of Washington, Seattle campus. This video contains details about our program that are of likely interest both for the interested prospective student and for prospective majors who are already here on campus.

There’s another video which gives an overview of the physics major and why you might want to choose physics, including the wide variety of post-graduation options that are open to our graduates. In this video, I'll give you details about whom to contact with your questions for physics student services, requirements for obtaining a physics degree or a physics minor if you decide to major in something else, and also the process by which students become physics majors. I will also spend a little time on some data from our annual exit survey of graduating seniors that you might find informative.

## Slide 2: Physics Student Services

If you have questions, the first place to start is with our Physics Student Services team. We’re located in the Physics Astronomy Tower in Room C139. Most of our advising, though, at the moment is via Zoom and email. The advising email, which all of us have access to, is phys-advise: physadvs@uw.edu. If you're not sure to whom you should direct your email, then please just send it to our physics advising email and it will get directed to the right contact person.

I am the Undergraduate Faculty Advisor. I spend about eight or 10 hours each week to meet with students who want advice from a physicist or a faculty member. I'm also the person who approves waivers or substitutions to any degree requirements or prerequisites.

Our director of student services is Catherine Provost. She's also our primary graduate advisor. Her main role for the undergraduates is to be a resource for grad school related issues.

Our staff advisors, or Academic Counselors, are Jeanny Mai and Paula Newcomer, and they can handle pretty much any undergraduate issue. They're highly knowledgeable about our department and the university and just life in general. They're great resources for our students, and we strongly encourage our students to stop by regularly and just keep us posted on what you're doing.

As you may have seen in the overview video, over two thousand students a year are involved in our introductory physics sequence. Our program coordinator for that sequence is Susan Miller. She knows everything about the logistics of handling that many students, all of whom are divided up into sections of 25 students in tutorial and in laboratory. She helps getting students added; she deals with disability accommodations, getting exams in the right places at the right time. Her email to reach her on these issues is physics - It's for the Physics 100 series, so it's phys1xx@uw.edu.

We’re very excited that starting next Monday, we will have a program assistant for the undergraduate program, Lihong Zhang. She's new to UW and I don't have an email address for her yet, but we're looking forward to having someone who will help direct students to the right

resources and also take care of administrative issues such as scheduling classrooms.

## Slide 3: Common Core Degree Requirements

Our physics major has four degree options, and the one you choose depends on your long term goals. However, each physics major must complete the same common core. The course starts with a five quarter overview, including the physics of motion, electricity and magnetism, oscillations and waves, thermal physics, and quantum physics.

Then the next step is to add the key tools that are required to do physics: mathematical methods, electronics lab, and also an overview of physics research that helps students get a picture of what's happening now in physics, as opposed to the long-established principles that are studied in their classrooms.

We also require of everyone a common sequence that applies these tools - the advanced electricity and magnetism sequence - and then at least four quarters of math: a year of calculus and then at least one quarter of linear algebra, differential equations, vector calculus, partial differential equations, complex analysis. We encourage you to take as many of these as you need to have your goals met. By the time you declare a major, it's likely that an applied math class in Python programing will also be added to this menu.

## Slide 4: Option Requirements

In addition to the common core, students then need to complete specific requirements for each degree option. The comprehensive track is for students who plan to go to graduate school in physics or astronomy (and I note that over 95 percent of astronomy majors double major in physics). The comprehensive option requires that you take at least five or six of our core, what I like to say are “call me a physicist” classes: the sort of thing that if someone is working as a physicist, you tend to expect them to know. We require that you take relativity and particles and another quarter of quantum mechanics, and then we require that you take at least three out of the third quarter of quantum mechanics or electricity and magnetism, classical mechanics, statistical mechanics, or also some of the core astronomy courses on the Solar System, the galaxy or stellar formation.

In the applied track, you don't need to take so many of those courses, just one from that list, but we require that you take an extra data analysis lab and also require that you learn to program - primarily we recommend you to do that in Python. Also, the applied degree option has more flexibility in the electives, for example, you can take an extra laboratory instead of a lecture class.

In our teaching physics [option], we again require relativity and particles and quantum mechanics, but then just one more from that core list and the electives then are essentially

all the teaching sequence for future teachers.

In the biological physics track, you take quantum and statistical mechanics from that core and also our core biophysics class, and then we require that you take an extra year or two of biology and chemistry and also that your capstone requirement for the bio physics degree must be in some biophysics related research.

That brings me to a little bit more detail on the capstone requirements.

## Slide 5: Capstone Requirement

Each graduate in our department is required to complete an experience where they apply what they've learned in the physics curriculum to an independent project outside the classroom. There are multiple ways to meet this requirement. Most students choose to do research in physics or astronomy. In the teaching track, we require that students do research related to physics, education, or they can also take the pedagogy course, which is a course where you basically participate in the teaching assistant training for the introductory classes and also learn some extra bits about pedagogy and basically prepare to be a learning assistant in our classes. As I mentioned earlier, the biological physics track asks that you do biologically related research that integrates your physics, biology and chemistry coursework.

In the applied or the comprehensive track, any of these are possible: research or pedagogy, and also, you can take the senior seminar courses which we offer, where you research a topic in current physics and present it to your peers, and also, of course, learn when your peers give those presentations to you. We have a directed reading in physics course, where students are paired with graduate students and learn how to read the scientific literature and then synthesize and present that back to their peers. Also, a number of students will take part in the engineering teams or do an internship or other activity outside the department. When a student’s research is not supervised by a physics or astronomy faculty member, we ask that they do write a paper explaining why this experience should meet the capstone requirement. Also, if you do a research project, for example at an internship, where you didn't actually receive credits, then you need to take an extra elective within our department so that there are credits, plus this paper, which we can assign to the requirements.

## Slide 6: Departmental Honors

Another aspect that we have recently changed is our honors program. Students in our honors program need to complete an undergraduate thesis, and it's based on research which is physics related. Most students do this with taking our physics research class, physics 499, but you can also do it out of the department or off-site with prior permission.

The honors program celebrates our top students. It requires a physics GPA of 3.6 or higher in all the courses beyond the intro level, and it basically is designed to encourage these strong students who are capable of getting into good graduate schools to get the experience of writing an undergraduate thesis, which is a very good one to prepare for graduate school and also to collect those all-important letters of recommendation which will help you get into graduate school.

As part of the thesis, students do research, they write up the project, and then also have both oral and poster presentations of their work - practice for going and attending physics conferences in their future careers. Also, we require that they then take part in the seminar where they hear about other students’ research projects and theses.

## Slide 7: Physics Minor

If you choose to major in something else but are still very interested in physics, and especially for students who maybe after they've explored the first five quarters of physics are ready to do something else or major in something related, then you can declare a physics minor.

The minor is quite popular for students in Engineering or the College of the Environment, because if you are double majoring in two different colleges, you need to meet the requirements at the college level for both of those degrees, in addition to just the major specific requirements.

So in the College of Environment or Engineering, the requirements to take courses outside your major [are less and those] to complete a foreign language don't exist. And so that's one reason that those students will often choose to have a physics minor.

In the minor, you take our same basic five courses and then you take a three-course advanced sequence. You can do that either by completing our physics by inquiry series designed for future teachers, or three of our experimental laboratories, or a more mathematically based course where you take the mathematical physics course and then either the electricity and magnetism or quantum mechanics that use those mathematical physics courses as a prerequisite.

## Slide 8: Declaring a Physics Major

Physics is a capacity constrained major, which means that you need to apply to the department in order to be admitted. To declare a major, first you need to complete one year of calculus and one year of introductory physics. We also ask that you be taking a 200-level physics class and also have taken a physics class within the previous couple of quarters. We find that students who are actively involved in taking physics courses at the time they declare, they are in general much more committed to the physics major and have a much higher probability of graduating with a degree in physics.

Before you declare, we ask that you develop a graduation plan and enter it into the UW tool called My Plan. This is primarily an advising tool. It both helps you figure out what it will take to get you graduated in a reasonable length of time, and it also helps us in Physics Student Services catch whether you're taking courses in the right order and in the quarters in which we plan to offer them. Most of our courses have a complicated prerequisite set, and also many of them are offered only one or two quarters each year, so it's important that you plan ahead to make sure you can fit all your courses in on time. Also, this plan can help you realize that you have choices on your electives and you should think through your career goals as you decide which electives you will take. We don't expect you to stick with this plan from here until graduation, but it is important that you think one out and then consciously make changes from that plan as you go forward.

The final aspect which is required of your physics application is a personal statement. In this, you explain your reasons for why you want to be a physics major and also the strategies you've developed to succeed in the major. If it's not obvious from your transcript that you'll excel in your physics classes, then we ask that you describe how you know you will succeed in future classes within your personal statement. You can refer to successes off campus or evidence that issues which prevented you from succeeding earlier have been dealt with.

The application is due at the beginning of October or April for admission into the major the following quarter. We do have an extra application window in winter quarter, which is primarily for transfer students or those who have more than 105 credits and more than 5 college quarters since high school, which means that the university requires them to declare a degree in that quarter.

We look holistically at a student's record. In general, student with a strong interest in physics who are getting A's and B's in their physics classes and their math classes are strong candidates for admission. The students we turned down, which is only about 20 percent or so each time, generally, they needed to think more deeply about what it is they want to major [in or take] further courses to either explore their options or get their study skills and their math and physics skills to the point where they are ready to succeed in our upper division courses.

Upon admission to the major, we also ask that all of our majors agree to our department's code of Conduct, and also that they meet with an advisor to approve their graduation plan. Our department website has much more information about this process, including some sample graduation plans.

## Slide 9: Criteria for Satisfactory Progress

Once students are in the major, we ask them to continue to make progress towards their degree in each quarter that they're enrolled. This means that they must take physics courses, courses from our math menu or electives in other departments that can meet our upper division requirements for electives each quarter. Exceptions are if you're doing a double major and you want to, say, take all of your economics courses one quarter in your physics courses another, or if you're doing a study abroad project - those are fine as long as they are pre-approved.

We also ask that you maintain a cumulative GPA of at least a 2.0 in all your physics classes and that you earn a numerical grade of at least 2.0 in each course used to satisfy the requirements of a physics major.

Typically, fewer than five percent of our majors are flagged for satisfactory progress in any given quarter. These students come in for advising, get directed to resources, and generally are back on track in a quarter or two.

Our Satisfactory Progress is not designed to kick students out of the major. It's designed to catch students who are having problems before those problems become permanent.

## Slide 10: Senior Exit Survey Results

I'd like to finish with some information about our majors: what do our students want to do after graduation and what happens to them once they're here?

We survey our students every year when they apply to graduate, which is somewhere between two and 10 months before they actually graduate.

## Slide 11: Career Goals

We asked our students to check all that apply of, “What sort of job do you envision yourself having in 10 to 15 years?” We find about half of our students imagine themselves as an engineer or doing research at an industry or a government lab. Doing some sort of computer or data science, or information technology is also a very popular goal. About a third imagine themselves in some form of teaching. Many students who are graduate school bound are thinking about becoming a professor, either at a university like the University of Washington or at a four-year or two-year college. A number of people are also interested in teaching at the K-12 level.

While those may be what you think about when you say, “Oh, what are the most common things that a physics graduate might want to do?”, it's also true that about 20 percent of our students are already planning on a non-STEM job, and many are looking at something like law or medicine, whether pursuing biomedical technology or actually going to medical school.

Many of our students have other ideas as well. Some of the things that were listed include astronaut, landscape architect, pilot, community organizer or just running my own business. Finally, a significant fraction of the students who are within 10 months of graduating check the box. “I haven't thought that far ahead. I have no idea.”

## Slide 12: Participation in Research

One way to discover what you like and what sort of job you might want to have in the future is to get involved in research while you're here at the university. It's a huge reason to come to the University of Washington as we are a premier research university, doing research really at the forefront of physics in a wide variety of different fields. If you are interested in a topic, chances are you can find someone here at the university, whether in physics or in a related department, who is doing research on that here. Also, pretty much everyone involves undergraduates in their research as well.

Even with the pandemic shut down, 60 percent of recent graduates had already done research for credit somewhere on campus, and another fifth or so planned to do so sometime before graduation [when filling out the exit survey]. About a sixth of our students said they had trouble either finding a project or fitting it into their schedule, but only about six percent said they were not interested in pursuing research. It is one of the key reasons people choose to come here to the University of Washington.

I looked at the transcripts of students who graduated in the two years before the pandemic shut down and found that over 300 distinct students had received credit for doing research,

with 43 distinct faculty members in physics for over 1200 credit hours, where each credit hour is equivalent to about three or four hours per week of research for a 10 week quarter. Our students are basically doing research, and we hope that you will, too.

In our pre-pandemic, it was about 80 percent of our graduates who received credit for doing research either in physics or elsewhere on campus. It's down a little bit due to the pandemic, but we are expecting it to return to these values soon.

## Slide 13: Factors extending time to degree

I would like to address something that often happens: Over 20 percent of our recent graduates have taken at least one academic quarter off after they arrive here at the university. It's a normal thing to do, even without the complications of remote instruction. And it's important to keep in mind that when you take time off for whatever reason, whether it's health or finance

or because another great opportunity came along, you're not dropping out of college, you're taking leave from the university.

The most common reason that students report for taking more than four years to graduate is that they decided too late on what they wanted to major in. We find that the implementation of having the application process to physics, and now direct-to-college admission in engineering and computer science, has helped to reduce this number. But it still is true: the sooner you start on your physics major, the sooner you'll graduate.

It's also true that in our courses, you need to work very hard for your credits, and many students choose to take a lighter road load and spread it out over time. Other students will decide to add an extra major or a minor, which also adds time. There are a lot of different reasons, and they're all normal, but I just want to give you a heads up that a large fraction of our students do end up taking more than four years.

## Slide 14: Preparation for Our Program

And finally, one last question is, “how prepared are you to major in physics?” Most of our graduating seniors said that their previous institutions, whether high school or community college, had prepared them well in terms of scientific reasoning and math skills and problem-solving skills and even physics knowledge, but what they were least prepared for was having good study skills and good time management skills. I strongly encourage you to work on those between now and what when you arrive at the university as, whether you major in physics or anything else, those will serve you well in your college career.

## Slide 15: Physics Student Services

We look forward to meeting with you and answering your questions about physics at the University of Washington.

Thank you again. I am Marjorie Olmstead, the Undergraduate Faculty Advisor in our physics department here at the University of Washington, Seattle.