Admitted Students Information Video Transcript

Slide 1: Welcome

Welcome,! Congratulations on your admission to the University of Washington, and thank you for wanting to learn more about the undergraduate program here at Seattle Campus and Physics at the University of Washington.

I'm Marjorie Olmstead. I've been on the faculty here for over 30 years. I currently serve as Associate Chair for Undergraduate Affairs and the Undergraduate Faculty Advisor in the physics department. In this video, I'll present an overview of physics as a major, and I'll also narrate an additional video later that you can watch with details.

As the undergraduate faculty advisor, I see our roughly 400 majors on a regular basis. I'm confident that if you truly want to major in physics and you put in the effort to build your skills and your knowledge, you will be able to graduate with a Bachelor of Science in Physics from the University of Washington. Our UW Admissions does a great job. If you've been admitted to our university:

Congratulations. You are smart enough and capable enough to succeed at whatever you choose to major in here at the university.

Every single one of you is welcome in our department, regardless of your academic prep preparation or also of what other identities you might hold in addition to that of physics students.

We recognize that each of you has had different opportunities to pursue math and physics in high school and for that reason, we offer four different levels of our first course in physics. No matter what your experiences have been before coming to UW, your first year might occasionally leave you feeling out of place. But by the time students are in their second year classes, pretty much everyone has caught up and we can't tell the difference.

The way this happens is we have a wide variety of campus resources that are designed to help you fill in any holes that you might have had in your background. It is, however, your responsibility to take advantage of these resources, but once you do, you'll find these many, many resources can smooth your path through the university and also help you transition to life beyond UW.

We are a large university that gives you a lot of opportunities, but it can also be easy to slip through the cracks if you ask for help. However, we are here we can, and we will help you.

## Slide 2: Physics Explains how the University Works

Why would you want to study physics? Well, physics is just cool, physics is how the universe works. When you understand physics, you'll understand how different pieces of matter interact and how they can interact with each other and also with light or other forms of radiation. You can understand the behavior of things from the clusters of galaxies down to the specific building blocks that make up the elementary particles that are inside atoms, and everything in between: the Earth, materials, how things are.

Physics also underlies the technologies that enable modern society. It was physicists who invented the World Wide Web to stay connected and share data in international collaborations. Your iPhone depends on quantum mechanics to work, uses transparent conductors, which is something that I've done research on; the transformation of energy among its different forms, the relationships between force and motion: All of these are key to physics.

Physics is a living, breathing field that makes discoveries new discoveries every day,and undergraduates in our department are highly involved in making these discoveries.Just in the past year or two, undergraduates have worked on research which ranges from applying machine learning techniques to understanding and discovering new fundamental particles that the atom smasher in Geneva to modeling the formation of galaxies. Students have worked on making superconductors that are only two atomic layers thick and using magnetic fields to understand the thoughts that babies have; from measuring the kinetics of biological enzymes as you pull them through a nano-sized pore to improving the performance of a Formula motor sports car.

And that's just a few of things that are going on here on campus. Beyond, there's limitless opportunities with what you can do when you understand physics and have a physics degree.

## Slide 3: Learning Physics at UW

The University of Washington, Seattle campus has the largest undergraduate program in physics in the country. In the most recent national data, there were only five schools that graduated more than 100 students per year, and for the last couple of years, we've actually graduated over 200. Our graduating class this year is somewhat lower because of how engineering and computer science have changed the way they accept students, and also we have gone to capacity constraint within the physics major. But we're aiming for a steady state of around one hundred and fifty graduates per year.

Ten years ago, we only graduated around 60, and this growth was accompanied by a decrease in the number of state funded physics faculty, and that was one of the main reasons we switched to being capacity constrained.

We are continuing, however, to provide an excellent education as a student, though it will be your responsibility to reach out to make the effort to be one of the students whose name we learn and one of the students that gets involved in our research.

Even though we're a big department, we build in opportunities at a variety of levels for you to get to know each other and our graduate teaching assistants. We have twenty five person breakout sessions in the 100 level, both in tutorial, which is pictured here and also in the laboratory. We have similar tutorials in our core 300 level courses as well. And also all of our laboratories, whether introductory or at the advanced level, you will be working in a group of two to four people in a class that has no more than 25, and in the senior labs, it's about 18.

Another thing which is really characteristic of learning physics here at the University of Washington is that our students are highly involved in our research. We have a capstone requirement for the physics degree, and about three quarters of our students meet that through research or through participation in other projects on campus for credit. Before the pandemic shut down, we typically had over a hundred and fifty students per year involved in for credit research, and we're slowly building that back up again now that we're back on campus full time.

We also have a very active chapter of the Society of Physics Students, which is a national organization, and it helps to provide community. Our students meet weekly with nationally known physicists who come to give our department a colloquium and also sponsor other sessions, study nights and movie nights and so forth. Pre-COVID, we would annually have a bunch of students go out to the gravitational observatory in Hanford, which is what's pictured here, and we hope to start that up again soon. We also just started a peer mentor program sponsored by our Climate and Diversity Committee. All these activities will build community and give students a chance to get to know other students, as well as other people in the department and beyond.

## Slide 4: Getting Started with the right 100-level course 8:11

As I mentioned earlier, each of you comes to the University of Washington with a unique background in physics, math and other skills needed for the physics major. And we just have different routes to get you introduced to physics as you arrive.

We offer four different introductory levels of physics distinguished by their second digit in their 100 level name. The Physics 101 and 102 courses are conceptual physics class that has the same level as math that you might have in a high school physics class, although the conceptual development then is now at the college level. These courses are designed for students who would not have the opportunity to take high school physics or pre-calculus before arriving at the university. Students will arrive in the autumn and then take both pre-calculus and physics 101 and then in the winter start calculus and take physics 102 if we have enough students to offer it. Then in the spring, they continue on with the second quarter of Calculus, Math 125, and start the General Engineering or Majors Course, Physics 121, in the spring.

For students who were interested in the life sciences, they offer, the 11x. or 114-15-16 series, which is algebra based and it's aimed at students who are majoring in biology, biochemistry and other life sciences. You can take all three quarters of that sequence in any of the four quarters per year, including summer.

If you are interested in physical science, physics, or engineering and you haven't taken high school physics but you're ready for calculus when you arrive, then if you don't have the high school physics,

we do recommend that you start with calculus first and then start your physics the following quarter and at the same time as the second quarter of calculus. During that first quarter, you can take physics 101, our conceptual physics class, or also while you're taking Physics 121 you can take our optional Physics 104 class, which is a two credit add-on to physics 121 and it focuses on what we call STEM fluency, STEM being science, technology, engineering and math, and these are the mathematical and scientific reasoning skills that you're going to need to thrive in your STEM classes. It was created this year with funds from the dean to help students who were underprepared due to COVID and we’re hopeful in being able to continue that into the future because many students have found it to be a really helpful bridge.

Most common in our first year class is students who have taken high school physics and are ready for calculus, either the first or the second quarter of calculus. If you've taken high school physics, then it's OK to take physics 121, the first quarter of physics, and math 124, the first quarter of calculus, at the same time. Many do choose to start the calculus first or to take physics 104 along with Physics 121.

As with the students who've not taken high school physics - typically about a third of the students in our intro class have not taken high school physics, so please don't feel like you're too late,

We welcome you in our physics class -- students who are ready to start math beyond the first quarter of calculus, whether or not you've taken high school physics, you're then ready for physics. 121. And if you've taken both a strong high school physics class, for example, an AP class that didn't give you credit for physics 121, and you also have taken, for example, AP calculus, then we strongly encourage you to think about taking the honors version, the 141-2-3 version of introductory physics. In the honors section, the material covered is basically the same. However, the professor will assume that you have been able to read and absorb from the textbook, and will spend time in class rather discussing it more generally and going into more depth. The basic syllabus is the same.

Once you get through the introductory course work, then it's time to decide what sort of physics or even anything else that you want to do next.

## Slide 5: UW Physics Degree Options

Within the physics degree, we have four degree options. These options depend on what your long-term career goals are. Which one you're going to want to choose: you should pick the degree option that gets you the education you want while taking the fewest number of courses that you don't want to take.

The comprehensive track is designed for students who want to go to graduate school in physics or astronomy. Here you take the full range of physics and math courses and including a very large subset of our advanced courses in the core of physics: quantum mechanics, relativity, particle physics, classical mechanics, statistical mechanics, electromagnetic radiation. And those students who very typically do their capstone as a research experience.

In the applied physics track, students who want to get a technical job at the bachelor's level or to go on and get a masters in engineering or data science after getting a grounding in physics.

Those are the students who are our most common applied physics students. The applied track has more flexibility in your electives. We don't require quite as many of those core upper division physics courses, and you can replace them with courses, say in applied math or engineering, which is more relevant, perhaps to your final career.

We also have a teaching track. This is aimed not only at future high school physics teachers, but also people who are interested in any way of communicating science to a general audience. For example, in science policy or developing educational materials for the general public or being a journalist. The teaching option is characterized by our physics by inquiry series, which is a 400 level sequence where you learn to write and talk about physics without using a lot of math in the fall. This 400 level course for future teachers meets in the same room as Physics 101, the conceptual physics course for students who did not have the opportunity to take high school physics or pre-calculus. In this way our physics 101 students can learn from our advanced students and our advanced students get practice explaining physics and communicating physics to interested, intelligent people who may just not quite have all of the same mathematical background.

Finally, our biological physics track is aimed at students who are interested in biomedical research working in the biomedical industry. It's also an excellent preparation for medical school. This track has a slimmed down physics core to make room for seven quarters of biology and chemistry, giving you a broad, interdisciplinary outlook that's needed for biological physics.

You can learn more about these degree options on our website, and their requirements are also detailed in my extra details video.

## Slide 6: Why major in physics?

As I said earlier, after your introductory physics, hopefully you'll decide you want to major in physics, but there are also over two dozen different departments on campus that accept introductory physics to meet a degree requirement. Many of them even have introductory physics as a prerequisite for applying to their degree. So one reason that we ask that you complete the introductory series before you declare your physics major is so that you have time to explore some of these options. University of Washington has over 200 undergraduate degree options, and that's even before you start to mix and match with minors and double majors. So you should really think through what you want to major and don't just decide that you want to major in physics because someone else back in middle school told you that you should major in physics, or because you got really interested in astronomy or in understanding the Higgs boson when you were in elementary school and now you're still building on that without reassessing whether that is actually what you want to do.

Great reasons to major in physics are that you have a deep desire to understand why and how the inanimate world works the way it does. Another good reason is that if you make a list of all the courses out of the thousands of courses offered here at the university, all of those courses that you want to take and then you compare it with the degree requirements for physics, astronomy or related fields, then you say, “Oh, the courses that I want to take will get me this degree.” And if you don't, if you have to add a whole lot of courses to that list that you didn't really want to take, then physics is not the right major for you.

Of our students who graduated in the last three years, they took over 2000 distinct courses here at the university, ranging from Aeronautical Engineering to Urdu. You should explore all of these opportunities before you settle on a major. We hope to convince you, of course, that physics is your best choice, but we don't want you here if you're not happy in the physics.

## Slide 7: Physics is Capacity-Constrained

As I mentioned earlier, physics is a capacity constrained major. Two years ago, along with most of the other physical sciences, we found that we had grown to the point where we were 30 percent larger than any other graduate undergraduate physics program in the country. We were bursting at the seams. And so we had a choice that we could either reduce the quality of our education we offer or we could reduce the number of majors. Like many of our peer departments here at the university, we chose to limit our number of majors.

We have found, however, that pretty much every student who truly wants to major in physics and has the skills and knowledge base that will allow them to succeed in our major and graduate. We have room essentially for all of those students. In the past, we've admitted 75 to 80 percent of our applicants each cycle and many of those who reapply the next cycle after improving their record get in on their second attempt.

## Slide 8: What does it take to be a physics major?

What are we looking for, what does it take to be a physics major here at the university? First and foremost is interest. You should be keen to learn about why and how matter interacts. You should also enjoy that process, which is known as mathematization of events and processes. This is what you're used to calling a story problem in math. In physics, you will look at some example of what's happening in the world and find a mathematical description of that actual process. Then once you're in the math, you can manipulate that math using your math skills and then turn it around to use that to make a prediction about your physical system.

Interest also means you can be proactive in your physics learning. Active participants in their own learning are the ones who succeed. We don't spoon feed you information. You're going to need to learn it on your own. You also should have a desire to have a career that will use the knowledge and skills that you pick up in a physics curriculum or a research lab. And I'll talk a little bit more about what those are later in this video.

The skills that you need the most important are time management and organization, followed shortly by problem solving and mathematical facility. That's true for anything you're going to major in that uses physics as a prerequisite here at the university, and these are almost all skills that students find they need to work on a little bit when they arrive, but usually have mastered after the first couple of years.

And finally, when you're starting to be the physics major, you need a knowledge base: algebra, trigonometry and calculus from your math courses, and then our introductory physics series, which covers mechanics - how things move and are acted upon by forces, how energy is transferred, electricity, magnetism, waves, optics -how light can be transported and steered, quantum mechanics and heat.

We ask that you complete this calculus series and intro series and then be enrolled in a 200-level physics and math class when you apply to the major. So students who start the introductory level physics 121 or 141 when they arrive, then theyt will apply in the autumn and their second year. Those who wait longer to start physics will then have to wait a little bit longer to join the physics major. This waiting for a year both gives you a chance to explore other majors and gives us a window into your knowledge and skills base when you apply.

There's a good possibility that we will have a way to apply during your third quarter of physics and calculus, but that is something which is currently going to be aimed at transfer students, but will be available to on campus students as well. That's in the process of being approved, so it's not certain yet.

## Slide 9: Our majors are happy and satisfied.

Once in the major, our majors tend to be happy and satisfied. Over 80 percent say they are satisfied with their choice of a physics major as they are applying to graduation, even though these students are students who were remote for most of the time during COVID. And in terms of quality of the overall program, our students rate us at least as highly as we rate them, with 90 percent giving us scores of good, very good and excellent.

## Slide 10: What comes next?

So once you've gotten that physics degree, what comes next? Basically, anything! Physics is a great liberal-arts STEM degree. A physicist is good at solving complex problems. They're very good at being presented with something they haven't seen before, and making connections to something they have because it is explained by similar mathematical principles. And then they can say, “Oh, this equation worked on my other system, maybe it will work on this new one.”

You can attend any graduate program that builds on this base. In physics, you're going to learn to work together on teams in labs, tutorials and study groups. You'll learn how to use the different expertise of the different people around you to solve problems. And those are highly transferable skills, whether you apply them in computing, in politics or in physics.

Our students go on to graduate school in physics and astronomy, but also in environmental science, electrical engineering, data science, library science; physics is also a great prep for law school or medical school. All of these it's useful to have a physics degree.

You can learn about physics and astronomy graduate schools at gradschoolsshopper.com, and you can also learn about various degrees and career options that are open at the Society of Physics Students national page. They have a great careers toolbox for students who are majoring in physics. That's at spsnational.org.

Those national resources are also useful to learn about what sorts of things you can do as a physicist in national data one year post-graduation. The most recent data shows that about half the students are employed within a year of graduation, and note these are students who came out during COVID. And about a third have gone on to graduate school in physics or astronomy and others in engineering or other graduate school, and only about six percent were still looking for a job. That's actually a little higher than usual, probably due to COVID, usually it's close to about four percent.

Of those who are employed, about three fifths are employed in the private sector, with the rest working at a college or university or teaching high school, or in some sort of a military or government lab or working for an NGO. Those in the private sector are mostly in engineering, computing and data science jobs.

## Slide 11: Immediate Plans after Physics B.S.

Here at the University of Washington, we have our large applied physics track, which is about half of our students. And that means that our students are a little bit more likely than the national average to go directly to work, and they're also more likely to go to graduate school in a field other than physics, just because we have this flexible applied physics degree. One thing you can also see is that only about a third of our students check they're more than 80 percent

likely to end up in any one particular area after graduation when they are applying to graduate. So that means anywhere from two to 10 months before they graduate, and this is normal. Our graduates have so many options that they're typically just figuring them out in their final year.

## Slide 12: Typical Job Titles/Salaries 1 yr post B.S.

If you look at job titles that physics graduates have a year after they get their bachelors: In computers, they tend to be software engineers or programmers or web developers; They're often a high school or a middle school science teacher, or working in all kinds of different engineering. Very popular ones are to be a systems engineer or an applications engineer or process engineer.

And our physics graduates earn good money. The data here in absolute numbers is about four years old, but the relative ranking [is correct]. We earn about the same as the people who are graduating in math or in nursing or economics, a little bit less than the computer science and engineering, but significantly more than those coming out with degrees in chemistry or biology or psychology. Physicists, when they get jobs in computer science and engineering, basically get the same salaries and so those are students who have chosen to do that.

Your probability of an engineering job goes way up if you also participate in things like the engineering teams, Husky Robotics, Formula One, Space X and so forth here on campus. Or go to the engineering job fairs where you can get a personal connection which will help you get past the H.R. computer, which might be looking for an engineering degree, whereas a person will know that your applied physics is actually almost more useful than the engineering degree.

## Slide 13: Who hires physics bachelors in Washington state?

In that same survey from the American Institute of Physics, you can see here a list of companies within the state of Washington who have hired physics bachelor recipients in the last five years. You'll see big names on here, like Boeing and Amazon and Google, and then also an array of smaller companies you haven't heard of. You'll see here in-between sized companies who are, say, suppliers for Boeing and so forth. You'll also find people who are being data scientists for the Institute for Health Metrics and Evaluation. So there's a very large possibility of places that you can work once you get your degree in physics.

## Slide 14: Occupation vs. college Degree: You have OPTIONS.

At the national level, the Census Bureau has asked people, what's your college major and what's your final occupation? And here what you can see is people in the green here have degrees that you might call STEM, although this also includes social sciences such as economics. And that's about a third of people getting their degrees and only about a sixth of the final occupations. So you really can end up almost anywhere with your STEM degree.

Within the physical sciences, which the Census Bureau defines as physics, chemistry, earth science and astronomy, you'll find that maybe a quarter end up in a similar field like that, and then another third or more end up in related fields, in life sciences, environmental science, engineering or health sciences, and many people also end up in a large variety of different fields. But that doesn't mean you're not doing physics. For example, Census Bureau knows I'm a professor, so I would show up here in education or someone in the visual and performing arts with a physics degree might well be programing physics dependent CGI in the movie industry.

You have a lot of options if you major in physics.

## Slide 25: We look forward to your joining us

We look forward to you joining us here as a student at the University of Washington. If you have questions, the email, our physics advising email, physadvs@uw.edu, will get your questions answered. You can also go to our website at phys.washington.edu/advising-student-services. There you can sign up for an appointment or come to our Zoom drop-in hours to get your questions answered.

As I mentioned at the beginning, each one of you is capable of graduating with a degree in physics from the University of Washington. We know you likely have a lot of choices about where to attend college and what to major in, but we sincerely hope that you will join us and become a Physics Husky.

This ends our overview video. If you're interested in more details, then please watch our more detailed information video.

But there's also a lot of information on our website phys.washington.edu.

Thank you, I’m Marjorie Olmstead and I look forward to meeting you.