Orientation Information for Physics and Astronomy Majors

For general information and help selecting your fall schedule, contact:

Joe Weingartner (call me Joe)
jweinga1@gmu.edu
http://physics.gmu.edu/~joe/

If you are majoring in physics, you have the option of doing a concentration in one of the following: astrophysics, computational physics, or applied & engineering physics. Or you can do no concentration. Regardless of your choice, the courses are identical in the first semester, so freshmen don't have to decide yet. The astronomy major does not have concentrations.

Pages 4 and 5 are checklists of the degree requirements for the astronomy and physics (no concentration) majors. The requirements are divided into two groups: Mason core and major courses. For the "written communication" Mason core requirement, you have to take specific courses, ENGH 101 and 302. For each of the other Mason core categories, you select 3 credits (usually one course) from a list of approved courses. Your major requirements satisfy the quantitative reasoning, information technology, natural science, and synthesis/capstone Mason core categories. (Note that, due to an error, the checklists do not indicate that the IT requirement is satisfied by the major requirements.)

Pages 6–9 are sample schedules for the astronomy and physics majors. For these sample schedules, it is assumed that you're an incoming freshman and will take Calc I during your first semester. Pages 10–13 are sample schedules for transfer students majoring in astronomy and physics.

My website: http://physics.gmu.edu/~joe/ has a number of links to help you with course selection and registration. Scroll down until you reach the section "GMU Links."

Patriot Web: https://patriotweb.gmu.edu/ Log in here with your Mason login to schedule and enroll in your courses. You can also view a schedule of courses for the semester to see which courses are being offered and which still have spots available.

Catalog: https://catalog.gmu.edu/ You can use this to search for information on specific courses and programs.

Sample Schedules: http://physics.gmu.edu/~joe/Sample-schedules.html Here you can find sample schedules for a wide range of scenarios, including the physics concentrations and cases where you need to take precalc your first semester or you've already completed Calc I.

Mason Core: https://catalog.gmu.edu/mason-core/ Here you can find the specific courses that you can use to satisfy the various Mason core categories. Click on a course link to find a brief description of the course.

Majors at Mason (degree worksheets): https://advising.gmu.edu/current-student/majors-at-mason/
Here you can find the checklists for the degree requirements; each of the physics concentrations is included.

Transfer Credit Policy: https://www2.gmu.edu/admissions-aid/how-apply/transfer/transfer-credit-policy

This page tells you what course credit you'll receive at GMU for your AP, IB, CLEP, etc. You'll want to check and see which Mason core and/or major requirements you already have covered.

Transfer Credit Matrix: https://admissions.gmu.edu/transfer/transferCreditSearch.asp If you've taken courses at other colleges, this page will tell you what course credit you'll receive here when you transfer the courses in.

Steps for Course Selection (freshmen)

1. For both physics and astronomy majors, Calc I is a prerequisite for nearly all of the other major courses. So your first step is to figure out which math course you'll take in the fall.

If you've already earned credit for Calc I or beyond (for example, with a sufficient grade on the AP exam), then you can register for the next course in the sequence (MATH 113 Calc I, MATH 114 Calc II, MATH 213 Calc III, MATH 214 Differential Equations and/or MATH 203 Linear Algebra). If you've already earned credit for a calc course but don't feel that you learned it solidly, then you should take it again here.

If you have not already earned credit for Calc I or beyond, then you should either take precalc (MATH 105) or Calc I (MATH 113). Usually there is a placement test for incoming students to determine which of these you should take. That is not available this summer. If you took "precalculus and trigonometry" in high school or college and got a C or better, or if you took calculus and got any grade, then you can register for MATH 113. Otherwise, register for MATH 105. For more detailed info, see the math department's site here: https://science.gmu.edu/academics/departments-units/mathematical-sciences/mathematical-sciences-testing-center

2. Select physics courses, if applicable. The first course in the required physics sequence, for both physics and astronomy majors, is PHYS 160 (lecture) and 161 (lab). Since Calc II (MATH 114) is a coreq for PHYS 160, you can only take PHYS 160/161 in the fall if you also take MATH 114 or beyond. (If course *A* is a coreq for course *B*, then you can only take *B* if you've already taken *A* or are taking *A* at the same time as *B*.) Physics and astronomy majors often want to take some sort of physics in their first semester, so we offer PHYS 122 and 123. These are both 1-credit, half-semester courses (122 the first half and 123 the second half) that cover relativity and quantum physics at a non-mathematical level. They are not required but most students really enjoy them. If you take them, they would count as electives towards your degree. So, depending on the math course you take in the fall, the physics course you should take is…

MATH 105 or 113: PHYS 122 and/or 123 or no physics
MATH 114: PHYS 160 and 161
MATH 213: PHYS 260 and 261

3. With your math and physics selections complete, it's time to round out your schedule with Mason core courses and/or courses to satisfy a minor or second major (if you'd like to do one of these). You'll probably want to aim for 14 or 15 credits total in your first semester. I usually recommend taking ENGH 101 as one of your Mason core courses during your first semester (unless you already have credit for it), but you can take it in a later semester if you prefer. Other Mason core categories to consider are:
oral communication
arts

global understanding
literature (if you've already completed ENGH 101)
social & behavioral sciences
western civilization/world history

First, check to see if any of the courses that you're bringing in (for example, from AP exams) satisfy any of the categories above. Use the "Transfer Credit Policy" and/or "Transfer Credit Matrix" links above to identify which of our courses you have credit for. Then use the catalog (link above) to search for that course. Its course description will indicate which, if any, Mason core category it satisfies.

You need 3 credits (usually 1 course) per category. (For the arts requirement, you can do 3 separate 1-credit performance courses. Or you can do a single 3-credit course, which is standard for the other categories.) From the categories above that you have not already satisfied, select courses that look like they might be interesting to you. Use the "Mason Core" link above to find courses that satisfy each category.

Note: If you are an astronomy major or physics major with an astrophysics concentration, your first astronomy course will come in the spring semester.

4. Once you've selected the courses you'd like to take in the fall, you can use Patriot Web (link above) to schedule them. The scheduling tool will search for sections of the courses that do not conflict with each other and offer you various possibilities, showing you what your full course schedule will look like each day of the week. It might not be possible to construct a schedule containing all of the courses you want. One or more might not be offered this semester, or might be full. Or, there might be a time conflict between two or more of the courses. In the case of conflicts, always prioritize math and physics. If you can't get all of the courses you wanted, then return to step 3 and find other Mason core course(s) to take instead.

College of Science - Astronomy, BS				
Catalog Year: 2019 - 2020			**Grades**	
Mason Core Requirements (27 credits)	**Course Information**	Credits	Earned	Needed
Written Communication:	ENGH 101 (100)	3		
Oral Communication:		3		
*Quantitative Reasoning	*Satisfied by Major Requirements			
Information Technology		3		
Arts		3		
Global Understanding		3		
Literature		3		
*Natural Science	*Satisfied by Major Requirements			
Social & Behavioral Sciences		3		
Western Civilization/World History		3		
Written Communication:	ENGH 302	3		
*Synthesis/Capstone	*Met by ASTR 402			
Major Requirements (69 credits) Students must complete a total of 55 credits in physics and astronomy and 14 credits in mathematics with a minimum GPA of 2.00				
Major Core Courses (10 credits)		Credits	Earned	Needed
ASTR 210	Introduction to Astrophysics	3		
ASTR 328	Stars	3		
ASTR 402	RS: Methods of Observational Astronomy	4		
Additional Astronomy Courses (Choose two of the following:)		6		
ASTR 403	Planetary Science			
ASTR 404	Galaxies and Cosmology			
ASTR 480	The Interstellar Medium			
***Astronomy and Physics Courses (15 credits from the following - at least 12 of which must be 300/400 level courses)**. If ASTR 403, 404 or 480 are not taken as pat of the additional astronomy course requirement above, they may be used here. ASTR 301, ASTR 408, PHYS 306, PHYS 307, PHYS 402, ASTR 403 or 404 or PHYS 428 or ASTR 480. Or other ASTR/PHYS courses with permission of the department				
Additional ASTR/PHYS Course #1:				
Additional ASTR/PHYS Course #2:				
Additional ASTR/PHYS Course #3:				
Additional ASTR/PHYS Course #4:				
Additional ASTR/PHYS Course #5:				
Required Physics Courses (24 credits)		Credits	Earned	Needed
PHYS 160/161	University Physics I with lab	4		
PHYS 260/261	University Physics II with lab	4		
PHYS 251	Intro to Computer Techniques in Physics	3		
PHYS 301	Analytical Methods of Physics	3		
PHYS 303	Classical Mechanics	**3**		
PHYS 305	Electromagnetic Theory	3		
PHYS 308	Modern Physics	3		
PHYS 416	Special Topics in Undergraduate Physics	1		
Required Math Courses (14 credits)				
MATH 113	Analytic Geometry and Calculus I (Mason Core)	4		
MATH 114	Analytic Geometry and Calculus II	4		
MATH 213	Analytic Geometry and Calculus III	3		
MATH 214	Elementary Differential Equations	3		
Degree Notes				
Approx. 24 remaining credits may be completed with elective courses to bring the degree total to 120 with 45 of these credits at the 300/400 level				
Advisor Note:				

College of Science - Physics, BS without Concentration				
Catalog Year: 2019 - 2020			**Grades**	
Mason Core Requirements: 27 credits	**Course Information**	Credits	Earned	Needed
Written Communication:	ENGH 101 (100)	3		
Oral Communication:		3		
*Quantitative Reasoning	*Satisfied by Major Requirements			
Information Technology		3		
Arts		3		
Global Understanding		3		
Literature		3		
*Natural Science	*Satisfied by Major Requirements			
Social & Behavioral Sciences		3		
Western Civilization/World History		3		
Written Communication:	ENGH 302	3		
Synthesis/Capstone	*Satisfied by Concentration Requirements			
Major Requirements (69 - 75 credits in major including concentration) **Students must complete a total of 75 credits in the major (69 credits if completing a second major), including at least 11 credits in mathematics, with a minimum GPA of 2.00.**				
PHYS 160	University Physics I	3		
PHYS 161	University Physics I Laboratory	1		
PHYS 251	Introduction to Computer Techniques in Physics	3		
PHYS 260	University Physics II (Mason Core)	3		
PHYS 261	University Physics II Laboratory (Mason Core)	1		
PHYS 301	Analytical Methods of Physics	3		
PHYS 303	Classical Mechanics	3		
PHYS 305	Electromagnetic Theory 1	3		
PHYS 307	Thermal Physics	3		
PHYS 308	Modern Physics	3		
PHYS 402	Intro to Quantum Mechanics and Atomic Physics	3		
PHYS 416	Special Topics in Undergraduate Physics	1		
MATH 113	Analytic Geometry and Calculus I	4		
MATH 114	Analytic Geometry and Calculus II	4		
MATH 213	Analytic Geometry and Calculus III	3		
BS without Concentration (28 - 34 credits in concentration)				
Select 6 credits from the following:		6		
PHYS 410	Computational Physics Capstone			
MATH 203	Linear Algebra			
MATH 214	Elementary Differential Equations			
PHYS 311	Instrumentation	3		
PHYS 312	Waves and Optics	3		
Research, Internship, or Independent Study: Select 3 credits from the following:		3		
PHYS 326	Problems in Physics II			
PHYS 405	Honors Thesis in Physics I			
PHYS 406	Honors Thesis in Physics II			
PHYS 408	Senior Research			
PHYS 409	Physics Internship			
PHYS 407	Senior Laboratory in Modern Physics	4		
PHYS 306	Wave Motion and Electromagnetic Radiation	3		
PHYS 403	Quantum Mechanics II	3		
PHYS 428	Relativity	3		
Only students who are not completing a second major must select 6 additional credits from the following: ASTR 210, 328, 403, 303; PHYS 370, 412, 440, 465, 475				
Additional Elective (if needed) #1:				
Additional Elective (if needed) #2:				
Degree Notes				
Approx. 18 - 24 credits may be completed with elective courses to bring degree to 120 with 45 credits at 300/400 level.				
Advisor Notes:				

Sample schedule for BS in astronomy

This sample schedule is for the case that fall of year 1 is an even year. (This distinction is necessary because some of the upper-level astronomy courses are offered every other year.)

Number of credits in parentheses.

Courses designated “Elective” are entirely at the student's discretion.

At least 45 credits must be upper-level (300 or above). This sample schedule satisfies this requirement.

Take at least 2 of ASTR 403, 404, 420, 480. In this sample schedule, these are ASTR 403 and (420 or 480). Other options are possible (e.g. replace ASTR 403 with an elective in fall of year 4 and take both ASTR 420 and 480 in spring of year 4).

Beyond the core astronomy, physics, and math courses, an additional 15 credits of astronomy and physics are required. In this sample schedule, these are ASTR 404, 408 and PHYS 306, 402, 428. There are other possibilities.

PHYS 122 and 123 are not required. They are included to bring the total credit number to 120.

Fall of Year 1 (15)

MATH 113	(4)	Calculus I
ENGH 101	(3)	Composition
Mason Core	(3)	
Mason Core	(3)	
PHYS 122	(1)	Inside Relativity
PHYS 123	(1)	Inside the Quantum World

Spring of Year 1 (15)

ASTR 124	(1)	Introduction to Observational Astronomy
MATH 114	(4)	Calculus II
PHYS 160	(3)	Physics I
PHYS 161	(1)	Physics I lab
Mason Core	(3)	
Mason Core	(3)	

Fall of Year 2 (16)

MATH 213	(3)	Calculus III
PHYS 260	(3)	Physics II
PHYS 261	(1)	Physics II lab
PHYS 251	(3)	Intro to Computer Techniques in Physics (satisfies Mason Core IT)
Mason Core	(3)	
Elective	(3)	

Spring of Year 2 (15)

MATH 214	(3)	Differential Equations
PHYS 308	(3)	Modern Physics
ASTR 210	(3)	Introduction to Astrophysics
Mason Core	(3)	
Elective	(3)	

Fall of Year 3 (15)

ASTR 328	(3)	Stars
PHYS 301	(3)	Analytical Methods of Physics
PHYS 303	(3)	Classical Mechanics
PHYS 305	(3)	Electromagnetic Theory
ENGH 302	(3)	Advanced Composition

Spring of Year 3 (15)

ASTR 404	(3)	Galaxies and Cosmology
PHYS 306	(3)	Wave Motion and Electromagnetic Radiation
PHYS 402	(3)	Quantum Mechanics
Elective	(3)	
Elective	(3)	

Fall of Year 4 (14)

ASTR 401	(3)	Computer Simulation in Astronomy
ASTR 402	(4)	Methods of Observational Astronomy
ASTR 403	(3)	Planetary Science
ASTR 408	(3)	Senior Research
PHYS 416	(1)	Special Topics in Modern Physics

Spring of Year 4 (15)

PHYS 428	(3)	Relativity
ASTR 420 or 480	(3)	Exoplanets or The Interstellar Medium
Elective	(3)	
Elective	(3)	
Elective	(3)	

Sample schedule for BS in physics (without concentration)

Number of credits in parentheses.

Courses designated “Elective” are entirely at the student's discretion.

At least 45 credits must be upper-level (300 or above). This sample schedule satisfies this requirement.

Students who are not completing a second major take 6 credits of physics and astronomy electives. In this sample schedule, ASTR 210 and PHYS 412 are selected; other options are possible.

ASTR 124 and PHYS 122 and 123 are not required. They are included to bring the total credit number to 120. A single 3-credit elective could be substituted for these.

Fall of Year 1 (15)

MATH 113	(4)	Calculus I
ENGH 101	(3)	Composition
Mason Core	(3)	
Mason Core	(3)	
PHYS 122	(1)	Inside Relativity
PHYS 123	(1)	Inside the Quantum World

Spring of Year 1 (15)

MATH 114	(4)	Calculus II
PHYS 160	(3)	Physics I
PHYS 161	(1)	Physics I lab
Mason Core	(3)	
Mason Core	(3)	
ASTR 124	(1)	Introduction to Observational Astronomy

Fall of Year 2 (16)

MATH 213	(3)	Calculus III
PHYS 260	(3)	Physics II
PHYS 261	(1)	Physics II lab
PHYS 251	(3)	Intro to Computer Techniques in Physics (satisfies Mason Core IT)
Mason Core	(3)	
Mason Core	(3)	

Spring of Year 2 (15)

MATH 203	(3)	Linear Algebra
MATH 214	(3)	Differential Equations
PHYS 307	(3)	Thermal Physics
PHYS 308	(3)	Modern Physics
ASTR 210	(3)	Introduction to Astrophysics

Fall of Year 3 (15)

PHYS 301	(3)	Analytical Methods of Physics
PHYS 303	(3)	Classical Mechanics
PHYS 305	(3)	Electromagnetic Theory
PHYS 311	(3)	Instrumentation
ENGH 302	(3)	Advanced Composition

Spring of Year 3 (15)

PHYS 306	(3)	Wave Motion and Electromagnetic Radiation
PHYS 312	(3)	Waves and Optics
PHYS 402	(3)	Introduction to Quantum Mechanics and Atomic Physics
Elective	(3)	
Elective	(3)	

Fall of Year 4 (14)

PHYS 403	(3)	Quantum Mechanics II
PHYS 407	(4)	Senior Laboratory
PHYS 408 or 409	(3)	Senior Research or Physics Internship
PHYS 416	(1)	Special Topics in Modern Physics
Elective	(3)	

Spring of Year 4 (15)

PHYS 412	(3)	Solid State Physics and Applications
PHYS 428	(3)	Relativity
Elective	(3)	
Elective	(3)	
Elective	(3)	

Sample schedule for BS in astronomy for transfer students

This sample schedule is for the case that fall of year 1 is an even year. (This distinction is necessary because some of the upper-level astronomy courses are offered every other year.)

Assumes that the student has the AA/AS waiver and has completed 60 total credits, including MATH 113, 114, 213, 214 and PHYS 160, 161, 260, 261.

PHYS 251 can be waived if the student has taken an appropriate python programming course (e.g. CSC 201 at V.C.C.S.).

Number of credits in parentheses.

Take at least 2 of ASTR 403, 404, 420, 480. In this sample schedule, these are ASTR 403 and 404. Other options are possible. Beyond the core astronomy, physics, and math courses, an additional 15 credits of astronomy and physics are required. In this sample schedule, these are ASTR 301, 408, 420, 480 and PHYS 428. There are other possibilities (e.g. PHYS 306 “Wave Motion and Electromagnetic Radiation”, PHYS 402 “Introduction to Quantum Mechanics and Atomic Physics”).

Fall of Year 1 (15)

ASTR 328	(3)	Stars
PHYS 251	(3)	Intro to Computer Techniques in Physics
PHYS 301	(3)	Analytical Methods of Physics
PHYS 303	(3)	Classical Mechanics
PHYS 305	(3)	Electromagnetic Theory

Spring of Year 1 (16)

ASTR 124	(1)	Introduction to Observational Astronomy
ASTR 210	(3)	Introduction to Astrophysics
ASTR 301	(3)	Astrobiology
ASTR 404	(3)	Galaxies and Cosmology
PHYS 308	(3)	Modern Physics
ENGH 302	(3)	Advanced Composition

Fall of Year 2 (14)

ASTR 401	(3)	Computer Simulation in Astronomy
ASTR 402	(4)	Methods of Observational Astronomy
ASTR 403	(3)	Planetary Science
PHYS 416	(1)	Special Topics in Modern Physics
Elective	(3)	

Spring of Year 2 (15)

ASTR 420	(3)	Exoplanets
ASTR 480	(3)	The Interstellar Medium
ASTR 408	(3)	Senior Research
PHYS 428	(3)	Relativity
Elective	(3)	

Sample schedule for BS in physics (without concentration) for transfer students

Assumes that the student has the AA/AS waiver and has completed 60 total credits, including MATH 113, 114, 213, 214 and PHYS 160, 161, 260, 261.

PHYS 251 can be waived if the student has taken an appropriate python programming course (e.g. CSC 201 at V.C.C.S.).

Number of credits in parentheses.

Courses designated “Elective” are entirely at the student's discretion.

Students who are not completing a second major take 6 credits of physics and astronomy electives. In this sample schedule, ASTR 210 and PHYS 412 are selected; other options are possible.

ASTR 124 is not required. It is included to bring the total credit number to 120.

Fall of Year 1 (15)

PHYS 251	(3)	Intro to Computer Techniques in Physics
PHYS 301	(3)	Analytical Methods of Physics
PHYS 303	(3)	Classical Mechanics
PHYS 305	(3)	Electromagnetic Theory
PHYS 311	(3)	Instrumentation

Spring of Year 1 (15)

PHYS 306	(3)	Wave Motion and Electromagnetic Radiation
PHYS 307	(3)	Thermal Physics
PHYS 312	(3)	Waves and Optics
PHYS 402	(3)	Introduction to Quantum Mechanics and Atomic Physics
MATH 203	(3)	Linear Algebra

Fall of Year 2 (14)

PHYS 403	(3)	Quantum Mechanics II
PHYS 407	(4)	Senior Laboratory
PHYS 408 or 409	(3)	Senior Research or Physics Internship
ENGH 302	(3)	Advanced Composition
PHYS 416	(1)	Special Topics in Modern Physics

Spring of Year 2 (16)

PHYS 308	(3)	Modern Physics
PHYS 412	(3)	Solid State Physics and Applications
PHYS 428	(3)	Relativity
ASTR 210	(3)	Introduction to Astrophysics
ASTR 124	(1)	Introduction to Observational Astronomy
Elective	(3)	