ASTRONOMY, BS

Banner Code: SC-BS-ASTR

Undergraduate Astronomy Advisor

203 Planetary Hall
Fairfax Campus

Phone: 703-993-5356
Email: uadvstr@gmu.edu
Website: physics.gmu.edu

This program prepares students for graduate school, a career in research or teaching, or employment in industry, business, or education fields where analytical skills and a scientific background are advantageous. Students who are considering a double major should talk to the undergraduate coordinator.

Admissions & Policies

Admissions

University-wide admissions policies can be found in Undergraduate Admissions Policies (https://catalog.gmu.edu/admissions/undergraduate-policies/).

To apply for this program, please complete the George Mason University Admissions Application (https://www2.gmu.edu/admissions-aid/apply-now).

Policies

Students must fulfill all Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2) including the Mason Core (https://catalog.gmu.edu/mason-core/).

At least 18 credits used to fulfill an Astronomy, BS cannot be used to fulfill another major or minor. Some course substitutions are allowed for double majors, subject to approval from the Department of Physics and Astronomy (https://catalog.gmu.edu/colleges-schools/science/physics-astronomy/).

By taking ASTR 402 RS: Methods of Observational Astronomy (Mason Core) (https://catalog.gmu.edu/mason-core/), astronomy majors satisfy the university's writing-intensive requirement.

For policies governing all undergraduate programs, see AP.5 Undergraduate Policies (https://catalog.gmu.edu/policies/academic/undergraduate-policies/).

Requirements

Degree Requirements

Total credits: minimum 120

Students should refer to the Admissions & Policies tab for specific policies related to this program.

Students must complete a total of 58 credits in physics and astronomy and 14 credits in mathematics with a minimum GPA of 2.00.

Required Astronomy Courses

Code	Title	Credits
ASTR 124	Introduction to Observational Astronomy	1
ASTR 210	Introduction to Astrophysics	3
ASTR 328	Stars	3
ASTR 401	Computer Simulation in Astronomy	3
ASTR 402	RS: Methods of Observational Astronomy (Mason Core) (https://catalog.gmu.edu/mason-core/) [1]	4
Total Credits		**14**

[1] Fulfills the writing intensive requirement.

Required Physics Courses

Code	Title	Credits
Choose one of the following two sequences:		**8**
Sequence One		
PHYS 160 & PHYS 161	University Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics I Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) (the lab can be taken with, or any time after, PHYS 160)	
PHYS 260 & PHYS 261	University Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) (the lab can be taken with, or any time after, PHYS 260)	
Sequence Two		
PHYS 170 & PHYS 161	Introductory and Modern Physics I (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics I Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) (the lab can be taken with, or any time after, PHYS 170)	

PHYS 270 & PHYS 261	Introductory and Modern Physics II (Mason Core) (https://catalog.gmu.edu/mason-core/) and University Physics II Laboratory (Mason Core) (https://catalog.gmu.edu/mason-core/) (the lab can be taken with, or any time after, PHYS 270)	
PHYS 251	Introduction to Computer Methods in Physics (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
PHYS 262	University Physics III (Mason Core) (https://catalog.gmu.edu/mason-core/)	3
PHYS 301	Analytical Methods of Physics	3
PHYS 303	Classical Mechanics	3
PHYS 305	Electromagnetic Theory	3
Total Credits		**23**

Required Math Courses

Code	Title	Credits
MATH 113	Analytic Geometry and Calculus I (Mason Core) (https://catalog.gmu.edu/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
Total Credits		**14**

Additional Coursework

Code	Title	Credits
Select 21 credits from the following:		21
ASTR 301	Astrobiology	
ASTR 403	Planetary Science	
ASTR 404	Galaxies and Cosmology	
ASTR 408	Senior Research	
or ASTR 409	Astronomy Internship	
ASTR 420	Exoplanets	
ASTR 480	The Interstellar Medium	
PHYS 306	Wave Motion and Electromagnetic Radiation	
PHYS 307	Thermal Physics	
PHYS 308	Modern Physics	
PHYS 311	Instrumentation	
PHYS 312	Waves and Optics	
PHYS 325	Intermediate Computer Methods in Physics	
PHYS 402	Introduction to Quantum Mechanics and Atomic Physics	
PHYS 403	Quantum Mechanics II	
PHYS 428	Relativity	
PHYS 440	Nuclear and Particle Physics	
PHYS 465	Planetary Atmospheres and Ionospheres	
PHYS 475	Atmospheric Physics	
Total Credits		**21**

Mason Core and Elective Credits

In order to meet a minimum of 120 credits, this degree requires an additional 48 credits, which may be applied toward any remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements (outlined below), Requirements for Bachelor's Degrees (https://catalog.gmu.edu/policies/academic/undergraduate-policies/#ap-5-3-2), and electives. Students are strongly encouraged to consult with their advisors to ensure that they fulfill all requirements.

Mason Core

Some Mason Core (https://catalog.gmu.edu/mason-core/) requirements may already be fulfilled by the major requirements listed above. Students are strongly encouraged to consult their advisors to ensure they fulfill all remaining Mason Core (https://catalog.gmu.edu/mason-core/) requirements.

All Integration-level requirements must be completed at George Mason and cannot be satisfied through transfer credit. These courses are integral to the university's educational philosophy and ensure that all graduates demonstrate proficiency in writing, critical thinking, and integrative learning consistent with the university's standards. Rare exceptions to this policy may only be granted by the Provost's Office.

Students who have completed the following credentials are eligible for a waiver of the Foundation and Exploration (lower level) requirement categories with the exception of Written Communication, which must be met by transferring in or taking an approved coruse at George Mason University. The Integration category (upper level) is not waived under this policy. See Admissions (https://catalog.gmu.edu/admissions/undergraduate-policies/#transfertext) for more information.

- VCCS Uniform Certificate of General Studies
- VCCS or Richard Bland Associate of Science (A.S.), Associate of Arts (A.A.), Associate of Arts and Sciences (A.A.&S.), or Associate of Fine Arts (A.F.A.)

Code	Title	Credits
Foundation Requirements		
Written Communication (lower-level) (https://catalog.gmu.edu/mason-core/#written)		3
Oral Communication (https://catalog.gmu.edu/mason-core/#oral)		3
Quantitative Reasoning (https://catalog.gmu.edu/mason-core/#quantitative)		3
Information Technology and Computing (https://catalog.gmu.edu/mason-core/#information-technology)		3
Exploration Requirements		
Arts (https://catalog.gmu.edu/mason-core/#arts)		3
Global Contexts (https://catalog.gmu.edu/mason-core/#global-contexts)		3
Global History (https://catalog.gmu.edu/mason-core/#global-history)		3

Literature (https://catalog.gmu.edu/mason-core/#literature)	3
Natural Science (https://catalog.gmu.edu/mason-core/#natural-science)	7
Social and Behavioral Sciences (https://catalog.gmu.edu/mason-core/#social-behavioral-science)	3
Just Societies (optional) (https://catalog.gmu.edu/mason-core/#justsocieties) [1]	
Integration Requirements	
Written Communication (upper-level) (https://catalog.gmu.edu/mason-core/#written-upper)	3
Writing Intensive (https://catalog.gmu.edu/mason-core/#wi) [2]	3
Mason Apex (https://catalog.gmu.edu/mason-core/#apex) [3]	3
Total Credits	**40**

1 In addition to covering content related to the designated category, Exploration level courses marked with a Just Societies "flag" are specifically designed to help students learn how to interact effectively with others from all walks of life, including those with backgrounds and beliefs that differ from their own. Students who wish to increase their knowledge and skills in this area may choose to enroll in a Just Societies-flagged course. Students interested in this approach to completing their Mason Core Exploration Requirements should work closely with their advisor to identify the appropriate Just Societies-flagged courses.

2 Most programs include the writing-intensive course designated for the major as part of the major requirements; this course is therefore not counted towards the total required for Mason Core.

3 Minimum 3 credits required.

Honors

Honors in the Major

Eligibility

Astronomy majors who have completed the prerequisites for ASTR 405 Honors Thesis in Astronomy I, have a GPA of at least 3.50 in ASTR and PHYS courses taken at Mason, and have a GPA of at least 3.50 in all courses taken at Mason may apply for admission to the astronomy honors program. Not all applicants who meet the minimum requirements are guaranteed acceptance. Please visit the department for details.

Honors Requirements

To graduate with honors in astronomy, a student must maintain a GPA of at least 3.50 in their ASTR/PHYS courses. Students accepted into the honors program must complete ASTR 405 Honors Thesis in Astronomy I and ASTR 406 Honors Thesis in Astronomy II with a GPA of at least 3.50 and a grade of ‘A-’ or better in ASTR 406 Honors Thesis in Astronomy II. Students in ASTR 405 Honors Thesis in Astronomy I/ASTR 406 Honors Thesis in Astronomy II will complete a research project and write a thesis working under the supervision of a faculty member. At the end of ASTR 406 Honors Thesis in Astronomy II, the student will write a substantial thesis paper and make a presentation of results to their honors committee.

Accelerated Master's

Bachelor's Degree (selected)/Quantum Science and Engineering, Accelerated MS

Overview

Highly-qualified undergraduates may be admitted to the combined bachelor's and accelerated master's degree pathway program (BAM Pathway) and obtain a Bachelor of Science degree in any College of Science major and a Master of Science in Quantum Science and Engineering in an accelerated time-frame after satisfactory completion of a minimum of 138 credits.

This accelerated option is offered jointly by undergraduate Bachelor of Science programs in the College of Science and the Quantum Science and Engineering, MS program, which is jointly offered by the College of Science (https://catalog.gmu.edu/colleges-schools/science/) and the College of Engineering and Computing (https://catalog.gmu.edu/colleges-schools/engineering-computing/).

Students in an accelerated master’s degree program must fulfill all university
requirements for the master's degree. See AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) for policies related to this program. For policies governing all graduate degrees, see AP.6 Graduate Policies (https://catalog.gmu.edu/policies/academic/graduate-policies/).

BAM Pathway Admission Requirements

Applicants to all graduate programs at George Mason University must meet the admission standards and application requirements for graduate study as specified in Graduate Admissions Policies (https://catalog.gmu.edu/admissions/graduate-policies/) and accelerated master's degree policies (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

Students must major in a College of Science Bachelor of Science program and will be considered for admission into the BAM Pathway after completion of a minimum of 60 credits.

Students who are accepted into the BAM Pathway will be allowed to register for graduate level courses after successful completion of a minimum of 75 undergraduate credits.

Accelerated Master's Admission Requirements

Undergraduate students already admitted to the BAM Pathway will be admitted to the intended master’s program if they have met the following criteria that will be verified:

- Submission of BAM Transition Form by stated deadline.
- Sufficient minimum 3.0 cumulative GPA for conferred undergraduate degree (which does not include any earned reserve graduate credits).
- Completion of approved advanced standing courses and any reserve graduate courses; please refer to policy A.P. 6.7

(https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7).

- Successful completion of required minimum of 120 credits needed for undergraduate degree conferral (after exclusion any satisfactory reserve graduate credits earned).
- Successfully meeting George Mason's requirements for undergraduate degree conferral (graduation) and timely submitting the application for graduation.

Accelerated Pathway Requirements

To maintain the integrity and quality of both the undergraduate and graduate degree programs, undergraduate students interested in taking graduate courses must choose from the following:

Advanced Standing Courses

Students must complete at least 3 credits from the following list of graduate-level courses while in undergraduate status, up to a maximum of 12.

Students are encouraged to consult with both their undergraduate advisor and the Quantum Science and Engineering, MS advisor:

Code	Title	Credits
Select from the following options:		**3-12**
Up to one 500-600 level specialized course from the following:		
ASTR 601	Computer Simulation in Astronomy	
BINF 690	Numerical Methods for Bioinformatics	
CS 583	Analysis of Algorithms	
CS 630	Advanced Algorithms	
CS 635	Foundations of Parallel Computation	
CSI 690	Numerical Methods	
ECE 511	Computer Architecture	
ECE 547	Applied Cryptography	
ECE 633	Error Control Coding	
ECE 647	Post-Quantum Cryptography	
GGS 579	Remote Sensing	
MATH 625	Numerical Linear Algebra	
MATH 685	Numerical Analysis	
MATH 686	Numerical Solutions of Differential Equations	
OR 541	Operations Research: Deterministic Optimization	
OR 542	Operations Research: Stochastic Models	
OR 646	Stochastic Optimization	
PHYS 510	Computational Physics I	
PHYS 613	Computational Physics II	
Remaining credits are selected from the following:		
QSE 500	Ideas in Quantum Science and Technology	
QSE 501	Mathematical Foundations of QSE [1]	
QSE 502	Programming Foundations of QSE [1]	
QSE 505	Classical and Quantum Information Theory	
QSE 511	Quantum Algorithms	
QSE 520	Applications of Quantum Technology	
QSE 570	Quantum Computing System Design	
or ECE 570	Quantum Computing System Design	

Reserve Credit Courses

Students may complete up to 6 credits while in undergraduate student status, of graduate-level coursework from the list below that will only count toward the graduate degree program.

Code	Title	Credits
Select up to 6 credits of not previously completed courses from the following:		**6**
QSE 500	Ideas in Quantum Science and Technology	
QSE 501	Mathematical Foundations of QSE [1]	
QSE 502	Programming Foundations of QSE [1]	
QSE 505	Classical and Quantum Information Theory	
QSE 511	Quantum Algorithms	
QSE 520	Applications of Quantum Technology	
QSE 570	Quantum Computing System Design	
or ECE 570	Quantum Computing System Design	

[1] As only one of these courses count for Quantum Science and Engineering, MS, credit, and these courses may not be necessary for all students, consult with an academic advisor prior to enrolling in QSE 501 Mathematical Foundations of QSE or QSE 502 Programming Foundations of QSE.

For more detailed information on coursework and timeline requirements, see AP.6.7 Bachelor's/Accelerated Master's Degree (https://catalog.gmu.edu/policies/academic/graduate-policies/#ap-6-7) and AP.1.4.4 Graduate Course Enrollment by Undergraduates (https://catalog.gmu.edu/policies/academic/registration-attendance/#ap-1-4-4).