

ASTRONOMY (ASTR)

100 Level Courses

ASTR 103: *Astronomy*. 3 credits.

Introduction to origin of life, Earth, planets and sun, stars, galaxies, quasars, nature of space radiation, and general theory of relativity. Note: ASTR 103 with ASTR 112 or ASTR 114 can be used to fulfill a 4-credit lab science requirement. Not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science Overview (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 111: *The Solar System*. 3 credits.

Topics include history of astronomy, evolution of the solar system, properties of planets, scientific method, critical thinking, nature of light, and principles of telescope design. Notes: ASTR 111 and 112 can be used to fulfill a 4-credit lab science requirement; not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science with Lab, Natural Science Overview (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 112: *The Solar System Lab*. 1 credit.

Laboratory course associated with ASTR 111. Notes: ASTR 111 and 112 can be used to fulfill a 4-credit lab science requirement; not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science with Lab (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Laboratory

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 113: *Stars, Galaxies, and the Universe*. 3 credits.

Topics include electromagnetic radiation, stellar evolution, interstellar medium, galaxies, cosmology, scientific method, and critical thinking. Notes: ASTR 113 and 114 can be used to fulfill a 4-credit lab science requirement; not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science with Lab, Natural Science Overview (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 114: *Stars, Galaxies, and the Universe Lab*. 1 credit.

Laboratory course associated with ASTR 113. Notes: ASTR 113 and 114 can be used to fulfill a 4-credit lab science requirement; not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science with Lab (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Laboratory

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 115: *Finding New Worlds*. 4 credits.

Topics include the search for planets outside the solar system, and new developments in the theory of solar system formation with an emphasis on student-led investigation using public data sources. Notes: ASTR 115 can be used to fulfill a 4-credit lab science requirement; not for physics majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science with Lab (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Laboratory, Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 124: *Introduction to Observational Astronomy*. 1 credit.

Practical introduction to observational astronomy using the campus observatory. Introduces the basic principles of light, telescopes, astrophotography, and image analysis. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Schedule Type: Laboratory

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

200 Level Courses

ASTR 210: *Introduction to Astrophysics*. 3 credits.

Introduction to astrophysics for scientists. Topics include astronomical measurement, celestial mechanics, electromagnetic radiation, stellar structure and evolution, the interstellar medium, galaxies, and a selection of topics at the forefront of astrophysics including space physics, exoplanets, galaxies, and cosmology. Offered by Physics & Astronomy

(<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: PHYS 160^C, 170^C or 160^{XS}.

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

300 Level Courses

ASTR 301: *Astrobiology*. 3 credits.

Physical science perspective on origin and evolution of life on Earth and how life, in turn, has significantly influenced Earth's evolution.

Topics include origin of Earth, mechanisms and sites for origin of life, co-evolution of life and Earth's atmosphere, habitability of planets, and the search for extraterrestrial life. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Recommended Prerequisite: MATH 108 or 113.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 302: *Foundations of Cosmological Thought*. 3 credits.

Examines scientific, historical, and philosophical foundations and development of cosmological thought from antiquity to the present. Emphasizes qualitative understanding of the development of cosmology concluding with the present concept of origin and evolution of universe.

Notes: No advanced background in mathematics or natural sciences required. This course does not satisfy elective-category requirements for the physics and astronomy majors. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science Overview (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 303: *Black Holes*. 3 credits.

Introduction to black hole systems. Topics include qualitative understanding of gravity in Newton's and Einstein's perspectives, stellar evolution and compact objects, characteristics of stellar and supermassive black holes, observational evidence of black holes from electromagnetic radiation and gravitational waves. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Natural Science Overview (<http://catalog.gmu.edu/mason-core/>)

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 328: *Stars*. 3 credits.

Stellar structure and evolution; radiative transfer. Includes computational work. Previous programming experience is not required, as it will be developed in the course, but it is helpful. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: ((ASTR 210^C or 210^{XS}) and (PHYS 260^C, 260^{XS} or 270^C)).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 390: *Topics in Astronomy*. 1-4 credits.

Selected topics not covered in fixed-content courses. May be repeated for credit with permission of department if topics are different. Notes: May not be included for credit by physics majors in the 45 credits of physics courses required for BS degree, or in 31 credits of physics courses required for BA degree. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the term for a maximum 9 credits.

Specialized Designation: Topic Varies

Schedule Type: Lec/Sem #1, Lec/Sem #2, Lec/Sem #3, Lec/Sem #4, Lec/Sem #5, Lec/Sem #6, Lec/Sem #7, Lec/Sem #8, Lec/Sem #9, Lecture, Sem/Lec #10, Sem/Lec #11, Sem/Lec #12, Sem/Lec #13, Sem/Lec #14, Sem/Lec #15, Sem/Lec #16, Sem/Lec #17, Sem/Lec #18

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

400 Level Courses

ASTR 401: *Computer Simulation in Astronomy*. 3 credits.

Techniques and methods to simulate astronomical phenomena using a computer. Examples taken from a wide variety of astronomical phenomena, including radiation transfer in astrophysical objects, self-gravitating systems, hydrodynamics, and stellar models. Notes: Emphasizes hands-on projects. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: ((ASTR 210^C or 210^{XS}) and (PHYS 251^C or 251^{XS})).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 402: *RS: Methods of Observational Astronomy*. 4 credits.

An introduction to the observational, statistical, and computational techniques used by observational astronomers. The course covers some of the basic skills needed to pursue a career in astronomy and is designed around preparing for and executing an observational research project. Fulfills writing intensive requirement in the major. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Mason Core: Capstone (<http://catalog.gmu.edu/mason-core/>)

Specialized Designation: Research/Scholarship Intensive, Writing Intensive in Major

Registration Restrictions:

Required Prerequisites: (PHYS 260^C, 260^{XS} or 270^C) and (ASTR 124^C or 124^{XS}) and (ASTR 210^C or 210^{XS}) and ASTR 401^C and (ASTR 328^C, 328^{XS}, 403^C, 420^C, 420^{XS}, 480^C or 480^{XS}).

* May be taken concurrently.

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Laboratory, Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 403: *Planetary Science*. 3 credits.

Introduction to the physics and chemistry of planets and their natural satellites, asteroids, and comets. Topics include history of the solar system; origin and evolution of planets, their internal structure and atmospheres; and analytical techniques used in remote and in situ study. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: ((ASTR 210^C or 210^{XS}) and (PHYS 260^C, 260^{XS} or 270^C)).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 404: *Galaxies and Cosmology*. 3 credits.

The structure of the Milky Way as the basis for our knowledge of galaxies; the properties of galaxies from our local neighborhood out to the youngest galaxies in the far distant universe; observational and theoretical approaches to the structure and evolution of galaxies; the basics of cosmology and the formation of structure in the universe. Computational tools introduced in ASTR 328 are developed further. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: (ASTR 328^C or 328^{XS}).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 405: *Honors Thesis in Astronomy I*. 3 credits.

Project chosen and completed under the guidance of a faculty member, resulting in a written thesis. An oral progress report is required for ASTR 405. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: (((ASTR 210^C or 210^{XS}) and (ASTR 328^C or 328^{XS})) or ASTR 402^C, 402^{XS}, PHYS 303^C, 303^{XS}, 305^C or 305^{XS}).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Enrollment is limited to students with a major in Astronomy.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 406: *Honors Thesis in Astronomy II*. 3 credits.

Project chosen and completed under the guidance of a faculty member, resulting in a written thesis. An oral progress report is required for ASTR 406. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisite: ASTR 405^C.

^C Requires minimum grade of C.

Enrollment is limited to students with a major in Astronomy.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 408: *Senior Research*. 3 credits.

Independent work under guidance of faculty member on research project in experimental, observational, or theoretical astronomy. Notes: Students may not receive more than 6 credits of ASTR 408 and 409. Written report on project required. May be taken twice with department permission. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 6 credits.

Registration Restrictions:

Required Prerequisites: (ASTR 210^C or 210^{XS}) and (ASTR 328^C, 328^{XS}, 402^C, 402^{XS}, PHYS 303^C, 303^{XS}, 305^C or 305^{XS}).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Research

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 409: *Astronomy Internship*. 3 credits.

On-the-job experience for astronomy majors in industry or government laboratories, including summer research programs. Students work in observational, experimental, or theoretical astronomy, and prepare written report at end of internship. Notes: See department for other requirements and application procedure prior to enrollment. Students may not receive more than 6 credits of ASTR 408 and 409. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: (ASTR 210^C or 210^{XS}) and (ASTR 328^C, 328^{XS}, 402^C, 402^{XS}, PHYS 303^C, 303^{XS}, 305^C or 305^{XS}).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Internship

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 420: *Exoplanets*. 3 credits.

Survey of exoplanet science. Topics include techniques for detecting and characterizing exoplanets, including their composition, atmospheres, and demographics. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: (ASTR 210^C or 210^{XS}).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 480: *The Interstellar Medium*. 3 credits.

Physical processes in the interstellar medium. Topics include the production and transfer of radiation, ionization and recombination, atomic and molecular excitation, dust physics, gas heating and cooling, and star formation. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). Limited to three attempts.

Registration Restrictions:

Required Prerequisites: ((ASTR 210^C or 210^{XS}) and (PHYS 260^C, 260^{XS} or 270^C)).

^C Requires minimum grade of C.

^{XS} Requires minimum grade of XS.

Schedule Type: Lecture

Grading:

This course is graded on the Undergraduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

500 Level Courses

ASTR 590: *Selected Topics in Astronomy and Astrophysics*. 1-6 credits.

Advanced topics from recent theoretical or observational developments and their applications. Satisfies needs of professional community to keep abreast of current developments. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 6 credits.

Specialized Designation: Topic Varies

Recommended Prerequisite: Permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

600 Level Courses

ASTR 601: *Computer Simulation in Astronomy*. 3 credits.

Techniques and methods to simulate astronomical phenomena using a computer. Examples taken from a wide variety of astronomical phenomena, including radiation transfer in astrophysical objects, self-gravitating systems, hydrodynamics, and stellar models. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: ASTR 210, PHYS 251

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 602: *Methods of Observational Astronomy*. 4 credits.

An introduction to the observational, statistical, and computational techniques used by observational astronomers. The course covers some of the basic skills needed to pursue a career in astronomy and is designed around preparing for and executing an observational research project. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Laboratory, Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 603: *Planetary Sciences*. 3 credits.

Introduction to the physics and chemistry of planets and their natural satellites, asteroids, and comets. Topics include history of the solar system; origin and evolution of planets, their internal structure and atmospheres; and analytical techniques used in remote and in situ study. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: ASTR 210, PHYS 260.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 604: *Galaxies and Cosmology*. 3 credits.

The structure of the Milky Way as the basis for our knowledge of galaxies; the properties of galaxies from our local neighborhood out to the youngest galaxies in the far distant universe; observational and theoretical approaches to the structure and evolution of galaxies; the basics of cosmology and the formation of structure in the universe. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: ASTR 328 and MATH 214.

Recommended Corequisite: PHYS 308.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 620: *Exoplanets*. 3 credits.

Survey of exoplanet science. Topics include techniques for detecting and characterizing exoplanets, including their composition, atmospheres, and demographics. Offered by Physics & Astronomy (<http://catalog.gmu.edu/>)

[colleges-schools/science/physics-astronomy/](http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/)). May not be repeated for credit.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 660: *Plasma Physics for Space and Astrophysics*. 3 credits.

Overview of space weather, including topics such as the sun, heliosphere, magnetosphere, and ionosphere. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit. Equivalent to PHYS 660.

Recommended Prerequisite: PHYS 305

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 680: *Physics of Interstellar Media*. 3 credits.

Physical processes in the interstellar media. Topics include the production and transfer of radiation, ionization and recombination, atomic and molecular excitation, dust physics, gas heating and cooling, and star formation. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: PHYS 402 or permission of instructor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy, Graduate, Junior Plus, Non-Degree or Senior Plus.

Enrollment is limited to Graduate, Non-Degree or Undergraduate level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

700 Level Courses

ASTR 730: *Stellar Astrophysics*. 3 credits.

Survey of contemporary astrophysics. Topics include physical concepts, stellar spectra, Hertzsprung-Russell diagram, stellar atmospheres,

stellar structure, interstellar matter, stellar evolution, high-energy phenomena, hydrodynamical processes in astrophysics, accretion disk formation, and shock formation. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: MATH 214, PHYS 303, 305, 308.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 765: High-Energy and Accretion Astrophysics. 3 credits.

Overview of the field of atomic and nuclear physics, including nuclear reactions of use to high-energy astrophysics. Discusses radiation processes in cosmic plasmas emphasizing quantum mechanical calculations; stellar evolution and nucleosynthesis; computational models of stellar evolution; binary stars and accretion disks; numerical models of the structure of accretion disks; compact stars, white dwarfs, neutron stars, and black holes; acceleration processes and cosmic rays; interstellar medium and propagation of cosmic rays; high-energy processes in the center of galaxies; and ground- and space-based techniques and observations. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May not be repeated for credit.

Recommended Prerequisite: PHYS 502 and 513, or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 790: Topics in Astronomy and Astrophysics. 1-6 credits.

Topics from recent theoretical or observational developments and applications not covered in fixed-content astronomy and astrophysics courses. Notes: Satisfies need of professional community to keep abreast of current developments. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 6 credits.

Specialized Designation: Topic Varies

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Lecture

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 796: Directed Reading and Research. 1-12 credits.

Reading and research on a specific topic in astronomy, astrophysics, or related field under the direction of a faculty member. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree.

Recommended Prerequisite: Admission to MS or PhD program and permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Research

Grading:

This course is graded on the Graduate Regular scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 798: Research Project. 3 credits.

Research project chosen and completed under the guidance of a graduate faculty member resulting in an acceptable technical report. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 6 credits.

Recommended Prerequisite: Nine graduate credits or permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Thesis

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 799: Master's Thesis. 1-6 credits.

Research project chosen and completed under guidance of graduate faculty member resulting in acceptable technical report and oral defense acceptable to three-faculty-member thesis committee. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree.

Recommended Prerequisite: 9 graduate credits and permission of instructor.

Registration Restrictions:

Enrollment is limited to Graduate or Non-Degree level students.

Students in a Non-Degree Undergraduate degree may **not** enroll.

Schedule Type: Thesis

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

900 Level Courses

ASTR 998: *Doctoral Dissertation Proposal.* 1-12 credits.

Covers development of a research proposal under the guidance of a dissertation director and the doctoral committee. The proposal forms the basis for the doctoral dissertation. Notes: Note: No more than 24 credits in ASTR/PHYS 998 and ASTR/PHYS 999 may be applied toward satisfying doctoral degree requirements in the physics PhD program. Out of the 24, no more than 12 credits of ASTR/PHYS 998 may be applied. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 21 credits.

Recommended Prerequisite: Admission to the Physics doctoral program, and permission of advisor.

Registration Restrictions:

Enrollment is limited to Graduate level students.

Schedule Type: Dissertation

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)

ASTR 999: *Doctoral Dissertation.* 1-12 credits.

Doctoral research performed under direction of dissertation director. Notes: No more than 24 credits in ASTR/PHYS 998 and ASTR/PHYS 999 may be applied toward satisfying doctoral degree requirements in the physics PhD program. Offered by Physics & Astronomy (<http://catalog.gmu.edu/colleges-schools/science/physics-astronomy/>). May be repeated within the degree for a maximum 24 credits.

Recommended Prerequisite: Admission to doctoral candidacy in Physics PhD program and permission of advisor.

Registration Restrictions:

Enrollment limited to students with a class of Advanced to Candidacy.

Enrollment is limited to Graduate level students.

Schedule Type: Dissertation

Grading:

This course is graded on the Satisfactory/No Credit scale. (<http://catalog.gmu.edu/policies/academic/grading/>)