Astronomy (ASTRON)

ASTRON 1010: Introduction to Astronomy
Survey of methods of astronomy; description of the solar system, stellar astronomy, structure of the galaxy and the universe. Three hours of lecture and one hour of lab per week (scheduled by the instructor). Satisfies physical science laboratory requirement. Laboratory section: Survey of astronomical methods, instruments, observations and measurement techniques.

Credit Hours: 4
Recommended: MATH 1100 or equivalent

ASTRON 1020: Introduction to Laboratory Astronomy
Laboratory supplement to ASTRON 1010. Satisfies physical science laboratory requirement. Survey of astronomical methods, instruments, observations and measurement techniques.

Credit Hours: 2
Recommended: MATH 1100

ASTRON 1050: Concepts in Cosmology
(same as PHYSCS 1050). This course explores the development of our understanding of the origin and evolution of the Universe. We will embark on a qualitative description of the Big Bang theory, the expansion of the universe and its current structure, the cosmic microwave background radiation, the existence of dark matter and dark energy and their implications for the Universe's ultimate fate.

Credit Hours: 3

ASTRON 1200: History of Astronomy
Astronomy is the oldest and yet the newest science discipline that has far-reaching impact on our civilization. This course aims to provide a brief historical account of the major milestones in Astronomy that have led to our current understanding of the universe. Graded on A-F basis only.

Credit Hours: 3

ASTRON 2888: Exploring Research in Astronomy
Introductory research course in astronomy where students develop research skills under the guidance of a faculty member. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U.

Credit Hours: 0
Prerequisites: instructor's consent

ASTRON 3010: Introduction to Modern Astrophysics
(same as PHYSCS 3010). Elements of stellar, and galactic astrophysics. Interpretation of observations and physical conditions of various astronomical objects including stars, gaseous nubulea and, galaxies.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 3888: Exploring Research in Astronomy
Introductory research course in astronomy where students develop research skills under the guidance of a faculty member. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

Credit Hours: 0
Prerequisites: instructor's consent

ASTRON 4020: Astrophysical Techniques
(same as PHYSCS 4020; cross-leveled with PHYSCS 7020, ASTRON 7020). Elements of modern astronomical instruments, observations and analysis, with the emphasis in the optical regime. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 4210: Contributions to Science from Under-represented Groups
(same as PHYSCS 4210; cross-leveled with ASTRON 7210, PHYSCS 7210). STEM fields are amongst the areas of human endeavor that struggle with increasing their human diversity. Teaching of science rarely discusses the contributions or marginalizations of under-represented groups. Meanwhile, many women and indigenous cultures have contributed to progress in STEM but are often not recognized. In this course we will investigate these contributions, and the lack of recognition both historically and in the present day. The aim is to provide students with a better understanding of the advantages of and challenges in inclusive, diverse science. Initially the course will use astronomy as its frame of reference because the sky was one of the earliest laboratories and consequently it has a long history with many indigenous cultures developing their own cosmologies and ways of studying the sky. As we discuss the role of Indigenous peoples, people of color, and women, we will investigate the role of power structures as well as systemic biases in the marginalization of these groups. This class will be strongly discussion oriented, with assessment based on the development throughout the semester, of a final project. As many students will be pursuing graduate school in STEM fields, the final project will be to develop a Broader Impact statement. Many federal funding agencies request or even require that research grants include a component aimed at "broadening participation", i.e. making STEM more inclusive and diverse. Student will work on a multipart assignment that will culminate in a Broader Impact statement - that may well be directly applicable to an NSF GRFP (Graduate Research Fellowship Program) or NSF Post-Doctoral Fellowship. In addition to the Broader Impact statement - students will give presentations and learn how to be more inclusive in

their presentation design, following the principles of Inclusive Design for Learning. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PHYSCS 2760 or PHYSCS 1200 or instructors consent

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ASTRON 4250: Stellar Astrophysics
(same as PHYSCS 4250). Basic astrophysics of stable and unusual stars, stellar systems. Investigates stellar dimensions, radiation, spectra, energy, evolution, populations; interstellar medium, stellar motions and aggregation.

Credit Hours: 3
Prerequisites: ASTRON 3010

ASTRON 4350: Galactic Astronomy
(same as PHYSCS 4350; cross-leveled with ASTRON 7350). Observational properties of normal galaxies and clusters of galaxies, Seyfert and emission-line structure and dynamics of galaxies; interacting galaxies, quasi-steller objects. Introduction to cosmology.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 4360: Extragalactic Astronomy
(same as PHYSCS 4360; cross-leveled with ASTRON 7360, PHYSCS 7360). This course introduces students to the most basic knowledge of extragalactic astronomy, starting from Milky Way and extending to the most distant universe. Topics covered will include galaxy morphology and classification, groups and clusters of galaxies, active galactic nuclei, and galaxy formation and evolution.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 4450: Introduction to Cosmology
(same as PHYSCS 4450; cross-leveled with PHYSCS 7450, ASTRON 7450). Develops the physical concepts necessary for understanding the major recent discoveries in cosmology, such as the acceleration of the universe and dark energy. No prior knowledge of general relativity is assumed.

Credit Hours: 3
Prerequisites: PHYSCS 3150 or equivalent

ASTRON 4460: Interstellar Medium
(same as PHYSCS 4460; cross-leveled with ASTRON 7750, PHYSCS 7750). The course discusses observational properties and physical and chemical processes occurring in the interstellar medium. Topics include interstellar diffuse and molecular clouds, HII regions, dust grains, interstellar chemistry, star formation, supernova remnants, and interstellar shock waves.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 4550: Cosmochemistry
(same as PHYSCS 4550; cross-leveled with ASTRON 7550, PHYSCS 7550). Cosmic dust, stardust, spectra, energy, interstellar medium, meteorites, astromineralogy.

Credit Hours: 3
Prerequisites: ASTRON 3010

ASTRON 4888: Research in Astronomy
Research conducted in the field of astronomy under the mentorship of a faculty member. Course appears on transcript for zero credit and does not count toward full-time enrollment. No tuition or fees are charged. Graded on S/U basis only.

Credit Hours: 0
Prerequisites: instructor's consent
Recommended: PHYSCS 2750

ASTRON 4950: Undergraduate Research in Astronomy
Special studies in astronomy; covers subjects not included in courses regularly offered.

Credit Hour: 1-3
Prerequisites: instructor's consent

ASTRON 4960: Senior Thesis in Astronomy
Special studies for senior undergraduate students in astronomy. The course requires an oral or poster presentations, or faculty-guided writing of a senior thesis involving independent research. Departmental consent required for repetition. Enrollment limited to students who have completed 3 credit hours of ASTRON 4950 or PHYSCS 4950.

Credit Hours: 3
Prerequisites: instructor's consent

ASTRON 7020: Astrophysical Techniques
(same as PHYSCS 7020; cross-leveled with PHYSCS 4020, ASTRON 4020). Elements of modern astronomical instruments, observations and analysis, with the emphasis in the optical regime. Graded on A-F basis only.

Credit Hours: 3

ASTRON 7210: Contributions to Science from Under-represented Groups
(same as PHYSCS 7210; cross-leveled with PHYSCS 4210, ASTRON 4210). STEM fields are amongst the areas of human endeavor that struggle with increasing their human diversity. Teaching of science rarely discusses the contributions or marginalizations of under-represented groups. Meanwhile, many women and indigenous cultures have contributed to progress in STEM but are often not recognized. In this course we will investigate these contributions, and the lack of recognition both historically and in the present day. The aim is to provide students with a better understanding of the advantages of and challenges in inclusive, diverse science. Initially the course will use astronomy as its frame of reference because the sky was one of the earliest laboratories and consequently it has a long history with many indigenous cultures developing their own cosmologies and ways of studying the sky. As we discuss the role of Indigenous peoples, people of color, and women, we will investigate the role of power structures as well as systemic biases in the marginalization of these groups. This class will be strongly discussion oriented, with assessment based on the development throughout the semester, of a final project. As many students will be pursuing graduate school in STEM fields, the final project will be to develop a Broader Impact statement. Many federal funding agencies request or even require that research grants include a component aimed at "broadening participation", i.e. making STEM more inclusive and diverse. Student will work on a multipart assignment that will culminate in a Broader Impact statement that may well be directly applicable to an NSF GRFP (Graduate Research Fellowship Program) or NSF Post-Doctoral Fellowship. In addition to the Broader Impact statement - students will give presentations and learn how to be more inclusive in their presentation design, following the principles of Inclusive Design for Learning. Graded on A-F basis only.

Credit Hours: 3
Prerequisites: PHYSCS 2760 or PHYSCS 1200 or instructors consent

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ASTRON 7350: Galactic Astronomy
(cross-leveled with PHYSCS 4350, ASTRON 4350). The course aims to introduce students to the basic knowledge of our Galaxy: how it looks like, how it might be formed, and how we have gained knowledge about it through observations. The main topics include distance measurement of stars, evolution of stars, interstellar medium, star clusters, the structure of Galaxy. The course will also briefly touch on "Near-field Cosmology" (sometimes referred to as "Galactic Archeology"), i.e., what we can infer from our Galaxy the general picture of galaxy formation and evolution.

Credit Hours: 3

ASTRON 7360: Extragalactic Astronomy
(same as PHYSCS 7360; cross-leveled with ASTRON 4360, PHYSCS 4360). This course introduces students to the most basic knowledge of extragalactic astronomy, starting from Milky Way and extending to the most distant universe. Topics covered will include galaxy morphology and classification, groups and clusters of galaxies, active galactic nuclei, and galaxy formation and evolution.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 7450: Introduction to Cosmology
(same as PHYSCS 7450; cross-leveled with PHYSCS 4450, ASTRON 4450). Develops the physical concepts necessary for understanding the major recent discoveries in cosmology, such as the acceleration of the universe and dark energy. No prior knowledge of general relativity is assumed.

Credit Hours: 3
Prerequisites: PHYSCS 3150 or equivalent or instructor's consent

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ASTRON 7550: Cosmochemistry
(same as PHYSCS 7550; cross-leveled with ASTRON 4550, PHYSCS 4550). Cosmic dust, stardust, spectra, energy, interstellar medium, meteorites, astromineralogy.

Credit Hours: 3
Prerequisites: ASTRON 3010

ASTRON 7750: Interstellar Medium
(same as PHYSCS 7750; cross-leveled with PHYSCS 4460, ASTRON 4460). The course discusses observational properties and physical and chemical processes occurring in the interstellar medium. Topics include interstellar diffuse and molecular clouds, HII regions, dust grains, interstellar chemistry, star formation, supernova remnants, and interstellar shock waves.

Credit Hours: 3
Prerequisites: PHYSCS 2760

ASTRON 8550: Stellar Structure and Evolution
(same as PHYSCS 8550). Reviews of atomic and molecular spectra. Investigates quantum radiation law, emission and absorption processes, radiation transfer theory, continuous and discrete line spectra of stars, stellar composition.

Credit Hours: 3
Prerequisites: ASTRON 4250, PHYSCS 4800, or instructor's consent

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