

ABSC 679 Practicum in Behavior—Analytic Research in Early Childhood (3-6). S A two-semester practicum providing opportunities for supervised training in one of several ongoing research projects in the field of behavior analysis, either basic or applied. Students assist in conducting research and participate in individual and group meetings to discuss and evaluate research and related methodological issues. (Formerly HDFL 688.) Prerequisite: ABSC/HDFL 308 and instructor permission. FLD

ABSC 680 Practicum in Advanced Laboratory in the Development of Behavioral Treatments for Children with Autism (1-6). S Students participate in an intensive behavioral treatment program teaching language, social skills, self-help skills, and academic skills to young children with autism. Students learn: to develop and implement treatment programs; design and use of a system of data collection and analysis; and apply the principles and philosophy of community and school mainstreaming. (Formerly HDFL 550.) Prerequisite: ABSC/HDFL 350 and instructor permission. LAB

ABSC 685 Practicum in Community-based Residential or Day Treatment Programs for Disabled Adults (3-6). S A one or two-semester practicum in which students are provided with the opportunity to work directly with developmentally disabled adults in either community-based residential or day treatment programs. Students are required to read relevant literature, carry out treatment programs, and participate in weekly meetings to discuss treatment goals and progress. (Formerly HDFL 696.) Prerequisite: ABSC/HDFL 304, ABSC/HDFL 410, and instructor permission. FLD

ABSC 687 Practicum in Behavioral Gerontology (1-6). S A one or two-semester practicum providing opportunities for supervised training in behavioral gerontology. Students: (a) read literature in the area of their specific practicum setting such as adult day care, senior centers, nursing homes; (b) assist in collecting information relevant to evaluating the program effectiveness of their efforts on behalf of the elderly; and (c) participate in discussions and planning meetings relevant to maintenance and improvement of operation of the practicum. (Formerly HDFL 644.) Prerequisite: ABSC/HDFL 342 or ABSC/HDFL 542 and instructor permission. FLD

ABSC 690 Practicum in Community Health and Development (1-6). U A two-semester practicum in which students engage in structured opportunities to practice core competencies related to the work of promoting community health and development (e.g., strategic planning, intervention, evaluation). In weekly group meetings, students prepare for their individual working field settings (e.g., health and human service agencies, research and advocacy organizations, community organizations). (Formerly HDFL 690.) Prerequisite: ABSC/HDFL 150, ABSC/HDFL 310, and instructor permission. FLD

ABSC 691 Practicum in Community Health and Development, Honors (1-6). U A two-semester practicum in which students engage in structured opportunities to practice core competencies related to the work of promoting community health and development (e.g., strategic planning, intervention, evaluation). In weekly group meetings, students prepare for their individual working field settings (e.g., health and human service agencies, research and advocacy organizations, community organizations). (Formerly HDFL 692.) Prerequisite: Open only to students in the University Honors Program; ABSC/HDFL 151, ABSC/HDFL 311 and instructor permission. FLD

ABSC 692 Practicum in Basic Research (3). S Practical supervised training in the laboratory study of human and/or animal behavior. Students assist in conducting basic research, read and discuss research articles, attend lab meetings, and acquire data analysis and presentation skills. Prerequisite: ABSC 308 (or concurrent enrollment) and permission of the instructor. RSH

ABSC 693 Practicum in Historical and Conceptual Foundations (3-6). S Practical supervised training in the historical and conceptual foundations of applied behavioral science (e.g., behavior analysis). Students research and read primary source literatures and write papers that advances our understanding of the field's foundations (e.g., empirical, theoretical). Prerequisite: ABSC 100/101, ABSC 304, ABSC 308, and ABSC 509 (or concurrent enrollment), and permission of instructor. IND

ABSC 694 Practicum in Juvenile Problems (3-6). S A one-semester practicum providing opportunities for students to aid professionals in the development and implementation of behavioral treatment plans with adolescents. Regularly scheduled individual and group meetings enable the evaluation of the practicum students' progress while working in the rehabilitative process for juveniles who have problems that can bring them into contact with the juvenile justice system. (Formerly HDFL 694.) Prerequisite: ABSC/HDFL 410, ABSC/HDFL 560, and instructor permission. FLD

ABSC 695 Special Practicum in: ____ (3-6). S A one or two-semester practicum providing opportunities for supervised, hands-on training outside the existing specialty areas or their options. This practicum must be arranged with the prior approval of a faculty adviser and the department's Undergraduate Curriculum Committee. Students should see an adviser about this practicum early in their junior year. Prerequisite: Instructor permission. FLD

ABSC 696 Special Practicum in, Honors: ____ (3-6). S A one or two-semester practicum providing opportunities for supervised, hands-on training outside the existing specialty areas or their options. This practicum must be arranged with the prior approval of a faculty adviser and the department's Undergraduate Curriculum Committee. Students should see an adviser about this practicum early in their junior year. Prerequisite: Open only to students in the University Honors Program and instructor permission. FLD

ABSC 698 Special Research Practicum in: ____ (3-6). S A one or two-semester research practicum providing opportunities for supervised, hands-on research training outside the existing specialty areas or their options. This practicum must be arranged with the prior approval of a faculty adviser and the department's Undergraduate Curriculum Committee. Students should see an adviser about this practicum early in their junior year. Prerequisite: Instructor permission. FLD

ABSC 699 Special Research Practicum in, Honors: ____ (3-6). S A one or two-semester research practicum providing opportunities for supervised, hands-on research training outside of the existing specialty areas or their options. This practicum must be arranged with the prior approval of a faculty adviser and the department's Undergraduate Curriculum Committee. Students should see an adviser early in their junior

year about the practicum and its prerequisites and requirements. Prerequisite: Open only to students in the University Honors Program and instructor permission. FLD

ABSC 701 Parenting in Modern Society (3).

ABSC 702 Curriculum Development for Young Children (3).

ABSC 703 Leadership in Early Education Programs: Theory and Research (3).

ABSC 704 Research Practicum in Clinical Child Psychology (3).

ABSC 705 Pediatric Psychology (3).

ABSC 706 Special Topics in Clinical Child Psychology: ____ (3).

ABSC 709 Biology and Behavior (3).

ABSC 710 Community Health and Development (3).

ABSC 716 Experimental Problems in Community Settings (1-5).

ABSC 719 Experimental Field Work in Community Settings (1-5).

ABSC 721 Biological Bases of Mental Retardation (4).

ABSC 723 Adolescent Adjustment (3).

ABSC 725 Research Methods and Application (3).

ABSC 730 Developmental Neurobiology (3).

ABSC 735 Within Subjects Research Methodology and Direct Observation (3).

ABSC 741 Readings in Gerontology (3-5).

ABSC 742 Research in Gerontology (1-10).

ABSC 756 Philosophical Bases of Early Childhood Education (3).

ABSC 765 Evaluating and Disseminating Scientific Material I (1-3).

ABSC 787 Gerontology Proseminar (3).

ABSC 788 Designing Early Education Environments (3).

ABSC 796 Laboratory in Behavioral Development and Modification: The Analysis of Behavior I (3).

ABSC 797 Proseminar in Child Language (2).

ABSC 798 The Analysis of Behavior II: Conceptual Foundations, Advanced Principles, and Contemporary Issues (3).

Arabic

See African and African-American Studies in this chapter of the catalog.

Art

See the School of Fine Arts chapter of this catalog.

Art History

See History of Art in this chapter of the catalog.

Astronomy

(Offered within the Department of Physics and Astronomy)

Chair: Stephen J. Sanders

Associate Chair: Philip S. Baringer

Malott Hall, 1251 Wescoe Hall Dr., Room 1082

Lawrence, KS 66045-7582, www.physics.ku.edu, (785) 864-4626

Degrees offered: B.A., B.S.

Why study astronomy? Because understanding the physical universe starts here.

The astronomy curriculum offers students a survey of modern astronomy and an introduction to physical science, gives science and engineering students an introduction to astronomy and astrophysics, and prepares students majoring in astronomy for graduate study in astronomy or related fields.

Courses for Nonmajors

ASTR 191 is a survey of contemporary astronomy, taught at a level using basic mathematics; ASTR 391 offers an introduction to physical astronomy at a calculus-based level. ASTR 196 is a laboratory course suitable as a companion for either introductory astronomy course

Majors

Students considering a major in astronomy should confer early with a departmental representative about the selection of courses. The B.A. degree is appropriate for students who want a

general education in astronomy as part of a broadly structured liberal education. The B.S. is a more specialized program with a substantial emphasis on physics content as well as astronomy. It provides preparation for a professional career or graduate work in astronomy, astrophysics, or related fields. A total of 124 credit hours is required for graduation.

First- and Second-year Preparation. All major programs in physics and astronomy share requirements in basic physics and mathematics including PHSX 150, a seminar course for majors. Completion of MATH 121 and MATH 122 in the first year allows students to start calculus-based physics foundation courses (PHSX 211 or PHSX 213, followed by PHSX 212 or PHSX 214) by the second semester. Majors are encouraged to take PHSX 213 and PHSX 214, the honors versions of PHSX 211 and PHSX 212. Students should take these courses and ASTR 391 in their first two years. B.S. astronomy majors normally complete additional course work in mathematics (MATH 223, MATH 290, and MATH 320), as well as PHSX 313 and PHSX 316, in the second year.

Requirements for the B.A. Major. In addition to general education requirements for B.A. degrees in the College, 39.5 hours of astronomy, physics, mathematics, and chemistry are required.

Foundational Physics, Mathematics, and Basic Science (23.5 hours)
 PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics0.5
 PHSX 211 (or PHSX 213) and PHSX 212 (or PHSX 214) General Physics I and II ... 8
 MATH 121 and MATH 122 Calculus I and II 10
 CHEM 184 Foundations of Chemistry I 5

Astronomy Requirements (16 hours)
 ASTR 196 Introductory Astronomy Laboratory (1) **or**
 ASTR 596 Observational Astrophysics (1) 1
 ASTR 391 Physical Astronomy, Honors 3
 ASTR 390 Undergraduate Problems 3
 ASTR 591 Stellar Astronomy 3
 ASTR 592 Galactic and Extragalactic Astronomy 3
 PHSX 693 Gravitation and Cosmology (3) **or**
 ASTR 691 Astrophysics I (3) **or** GEOL 572 Geophysics (3) 3

Requirements for the Bachelor of Science Degree

Foundational Physics, Mathematics, and Chemistry (23.5 hours)
 PHSX 150 Seminar in Physics, Astronomy, and Engineering Physics0.5
 PHSX 211 (or PHSX 213) and PHSX 212 (or PHSX 214) General Physics I and II ... 8
 MATH 121 and MATH 122 Calculus I and II 10
 CHEM 184 Foundations of Chemistry I 5

Astronomy Requirements (20 hours)
 ASTR 391 Physical Astronomy, Honors 3
 ASTR 596 Observational Astrophysics1
 ASTR 591 Stellar Astronomy 3
 ASTR 592 Galactic and Extragalactic Astronomy 3
 PHSX 693 Gravitation and Cosmology 3
 ASTR 691 Astrophysics I 3
 ASTR 692 Astrophysics II 3
 ASTR 503 Undergraduate Research 1

Physics Requirements (23 hours)
 PHSX 313 General Physics III (3) and
 PHSX 316 Intermediate Physics Laboratory I (1) 4
 PHSX 511 Introductory Quantum Mechanics 3
 PHSX 521 Mechanics I 3
 PHSX 531 Electricity and Magnetism 3
 PHSX 536 Electronic Circuit Measurement and Design (4) **or**
 PHSX 516 Physical Measurements (4) 4
 PHSX 671 Thermal Physics 3
 Advanced physics elective 3
 (any lecture or laboratory course numbered 500 or higher, including
 ASTR 795/PHSX 795 Space Plasma Physics and GEOL 572 Geophysics.)

Advanced Mathematics Requirements (11 hours)
 MATH 223 Vector Calculus (3) and MATH 290 Elementary Linear Algebra (2) ... 5
 MATH 320 Elementary Differential Equations 3
 MATH elective 3

(This may be chosen from PHSX 518, PHSX 718, MATH 526, MATH 530, MATH 558, MATH 581, MATH 590, MATH 628, MATH 646, MATH 647, MATH 648, MATH 660, MATH 661, or any 700-level MATH lecture course except MATH 701 and MATH 715.)

Other Requirements

English: satisfaction of the B.A. requirements. If requirements can be met in fewer than 9 hours, the remaining hours become free electives (ENGL 362 Foundations of Technical Writing is accepted as the third English course) ... 9
 Humanities: two courses, including at least one principal course 6
 Social sciences: two courses, including at least one principal course 6
 Western civilization 6
 EECS 138 Introduction to Computing: FORTRAN or C++ (3) **or**
 EECS 168 Programming I (4) 3-4
 Approximately 16 credit hours of free electives in courses outside the major are needed to complete the required 124 credit hours 16

Requirements for the Minor (20 hours)

PHSX 211 (or PHSX 213) General Physics I 4
 PHSX 212 (or PHSX 214) General Physics II 4
 PHSX 313 General Physics III (3) and
 PHSX 316 Intermediate Physics Laboratory (1) 4
 ASTR 391 Physical Astronomy, Honors (students ineligible to take ASTR 391 should take ASTR 390) 3
 Any combination of ASTR courses numbered above 300 at least 5

Honors. Qualified students earning either a B.A. or a B.S. degree with a major in astronomy may graduate with honors by meeting these requirements:

1. By the end of the candidate's final semester, he or she must earn a minimum grade-point average of 3.25 overall and 3.5 in the major in all courses taken in residence and elsewhere.
2. The candidate must complete at least 24 credit hours of astronomy and physics courses numbered 500 or above, including undergraduate research represented by 4 hours of credit in ASTR 596, ASTR 597, PHSX 500, or PHSX 501, with a grade of B or higher.
3. The results of the research must be presented in written form and accepted by three members of the department faculty.

A student who plans to graduate with honors in astronomy must file a declaration of intent form with the departmental honors coordinator, preferably during his or her junior year, but no later than enrollment for the final undergraduate semester.

Astronomy Courses

ASTR 190 Astronomy and Civilization (3). N A survey course that describes the interplay between the science of astronomy and cultural beliefs. It uses, among others, examples of how religious and philosophical tenets have enhanced or conflicted with scientific principles. Not for astronomy majors. LEC

ASTR 191 Contemporary Astronomy (3). NP N The structure and evolution of the universe, from nearby planets to distant quasars, are examined. Topics include recent discoveries concerning planets, stars, galaxies, pulsars and black holes as well as their evolution, the structure of the universe today and how it will be in the future. The emphasis is descriptive rather than mathematical. Concurrent enrollment in ASTR 196 suggested, but not required. Prerequisite: One year each of high school algebra and geometry. LEC

ASTR 196 Introductory Astronomy Laboratory (1). U An introduction to astronomical observations and methods. Students have the opportunity to use the telescopes at the K.U. observatory. The course includes constellation recognition, finding celestial objects, and interpreting astronomical data. A companion course to ASTR 191 or ASTR 391. Counts as a laboratory science when preceded or accompanied by ASTR 191 or ASTR 391. Prerequisite or corequisite: ASTR 191 or ASTR 391. LAB

ASTR 293 Astronomy Bizarre (3). N An exploration of astronomical extremes from various points of view: extremes in ages (the Big Bang and recent star formation), velocities and distances (quasars), rotation (pulsars), density (white dwarfs, neutron stars, black holes), energy release (stellar explosions), and proximity (interacting binary stars). Prerequisite: Survey course in astronomy. LEC

ASTR 294 The Quest for Extraterrestrial Life (3). N An introduction to the search for planets around other stars and for life in the universe beyond the earth. A discussion of the astronomical conditions under which life might form and the biological conditions of life formation and evolution. Methods of searching for extraterrestrial life. Does not satisfy major requirements. Prerequisite: An introductory course in biology or astronomy. LEC

The Mount Oread Scholars program, Strong Hall, 1450 Jayhawk Blvd., Room 126, Lawrence, KS 66045-7535, (785) 864-2834, offers special opportunities, advising, and support to academically qualified first-year KU students.

ASTR 390 Undergraduate Problems (1-3). N Undergraduate observational or theoretical problems in astronomy. Maximum credit, six hours. Prerequisite: Permission of department. IND

ASTR 391 Physical Astronomy, Honors (3). NP/N An honors, calculus-based introduction to astronomy and astrophysics, required for astronomy majors. Components of the Universe—from planetary systems, stellar systems, large scale structure and cosmology—are examined to illuminate the physics principles which govern their evolution. Not open to students with prior credit in ASTR 191 or ASTR 291. Prerequisite: MATH 121, and either permission of instructor, or participation in the University Honors Program. LEC

ASTR 503 Undergraduate Research (1-4). N This course is for students seeking to fulfill the undergraduate research requirement. Students are expected to participate in some area of ongoing research in the department, chosen with the help of their adviser. At the end of the term, students will present their results in a seminar to other students and faculty. (Same as EPHX 503 and PHSX 503.) Prerequisite: Junior/Senior standing in Astronomy, Engineering Physics, or Physics, or permission of instructor. IND

ASTR 591 Stellar Astronomy (3). N Fundamentals of stellar astronomy including astronomical optics and techniques, coordinate and time systems, stellar spectroscopy, properties of normal, binary and variable stars. Prerequisite: PHSX 212. An introductory astronomy course is desirable. LEC

ASTR 592 Galactic and Extragalactic Astronomy (3). N A study of stellar groups, the interstellar medium, galactic structure and dynamics, galaxies, and cosmology. Prerequisite: ASTR 591 or consent of instructor. LEC

ASTR 596 Observational Astrophysics (1-3). N Students learn skills involved in modern observational techniques using the facilities of the K.U. observatory. Maximum credit, six hours. Prerequisite: ASTR 592. LEC

ASTR 597 Analysis in Astrophysics (1-3). N Individual students work on specialized research problems in the field of observational or theoretical astrophysics. Maximum credit, six hours. Prerequisite: ASTR 592. IND

ASTR 691 Astrophysics I (3). N An introduction to radiation processes, thermal processes, and radiative transfer in stellar atmospheres and the interstellar medium. (Same as EPHX 691 and PHSX 691.) Prerequisite: PHSX 313 or consent of instructor. LEC

ASTR 692 Astrophysics II (3). N The formation and evolution of stars, nucleosynthesis of the elements, and the physical processes of high energy physics. Prerequisite: ASTR 691 or consent of instructor. LEC

ASTR 791 Seminar in Astrophysics (1-3).

ASTR 795 Space Plasma Physics (3).

Atmospheric Science

(Offered within the Department of Geography)

Chair: Terry Slocum

Associate Chair: Johannes Feddema

Lindley Hall, 1475 Jayhawk Blvd., Room 213

Lawrence, KS 66045-7613, www.geog.ku.edu, (785) 864-5143

Undergraduate Coordinator: David Mechem, 404B Lindley Hall, (785) 864-4738

Degree offered: B.S. (several options)

Why study atmospheric science? The study of atmospheric processes enables us to understand human interactions with the environment.

The program provides a fundamental knowledge of the atmosphere and the weather it generates. Interactions between weather phenomena and human decisions and activities give the subject important applications. Several tracks lead to a Bachelor of Science degree.

Majors

Students who may decide to major in atmospheric science should confer early with a departmental representative about the selection of courses.

Requirements for the B.S. Degree. Four specialized options are available for students who plan professional careers in meteorology or atmospheric science. The general meteorology option satisfies all

the traditional professional meteorology requirements for employment with the National Weather Service, airlines, or other agencies. The air pollution meteorology option meets the need for trained specialists. The hydrometeorology option may lead to a career as a meteorologist in one of the many water-related activities in private and governmental agencies. The news media forecasting option can lead to a career forecasting the weather on television or radio. The B.S. degree with any of these specialties also prepares students to begin graduate programs in meteorology or atmospheric science.

General Requirements for All Options (94-95 hours)

ATMO 105 Introductory Meteorology	5
ATMO 321/GEOG 321 Climate and Climate Change	3
ATMO 505 Weather Forecasting	3
ATMO 521/GEOG 521 Microclimatology	3
ATMO 630 Synoptic Meteorology	3
ATMO 640 Dynamic Meteorology	3
ATMO 642 Remote Sensing	3
ATMO 660 Advanced Dynamic Meteorology	3
ATMO 680 Physical Meteorology	3
ATMO 697 Seminar for Seniors	1
CHEM 184 Foundations of Chemistry I	5
COMS 130 Speaker-Audience Communication (3) or	
COMS 150 Personal Communication (3) and	
COMS 330 Effective Business Communication (3)	6
EECS 138 Introduction to Computing; FORTRAN	3
ENGL 101, ENGL 102, and any 200-level English course or	
ENGL 362 Foundations of Technical Writing	9
EVRN 148 Scientific Principles of Environmental Studies	3
MATH 581 Numerical Methods	3
MATH 121, MATH 122, MATH 223, MATH 290, MATH 320 or MATH 220,	
MATH 526 Applied Mathematical Statistics I or DSCI 301 Statistics ...	21-22
PHSX 211 and PHSX 212 General Physics I and II	8
Humanities and social sciences (one course each)	6

General Meteorology Option (29 hours)

ATMO 525 Air Pollution Meteorology	3
ATMO 605 Operational Forecasting	2
ATMO 650 Advanced Synoptic Meteorology	3
Free electives	21

Air Pollution Meteorology Option (29 hours)

ATMO 525 Air Pollution Meteorology	3
CHEM 188 Foundations of Chemistry II	5
CE 477 Introduction to Environmental Engineering and Science	3
Free electives	18

Hydrometeorology Option (29 hours)

ATMO 525 Air Pollution Meteorology	3
ATMO 605 Operational Forecasting	2
CE 301 Statics and Dynamics	5
CE 330 Fluid Mechanics	4
CE 455 Hydrology	3
Free electives	12

News Media Forecasting Option (29 hours)

ATMO 605 Operational Forecasting	2
ATMO 650 Advanced Synoptic Meteorology	3
JOUR 301 Research and Writing	3
JOUR 415 Multimedia Reporting	3
JOUR 512 Principles of Broadcasting, Cable, and New Technologies	3
Free electives	15

Concentration in Business. A student may graduate from the School of Business with a concentration in atmospheric science. Departmental requirements are

Required Courses in Atmospheric Science

ATMO 321 Climate and Climate Change	3
ATMO 505 Weather Forecasting	3
ATMO 521 Microclimatology	3
ATMO 525 Air Pollution Meteorology	3
ATMO 640 Dynamic Meteorology	3
ATMO 680 Physical Meteorology	3
Prerequisites for these courses include	
ATMO 105 Introductory Meteorology	5
EECS 138 Introduction to Computing; FORTRAN	3

Atmospheric science offers options in general meteorology, air pollution meteorology, hydrometeorology, and news media forecasting.

The holdings of KU's Anschutz Library cover a complete range of chemistry, biology, and physics periodicals and books.