Term Information

Effective Term	Autumn 2026

General Information

Course Bulletin Listing/Subject Area	Astronomy
Fiscal Unit/Academic Org	Astronomy - D0614
College/Academic Group	Arts and Sciences
Level/Career	Undergraduate
Course Number/Catalog	2250
Course Title	Foundations of Astronomical Observation and Data Analysis
Transcript Abbreviation	Found. Obs & Anlys
Course Description	ASTRON 2250 teaches the fundamentals of observational astronomy through computational data analysis. Students learn how to process and analyze real survey data including spectra, time series data and images. The course also introduces LLM-assisted coding and emphasizes strong astronomical reasoning and computational methods.
Semester Credit Hours/Units	Fixed: 3

Offering Information

Length Of Course	14 Week
Flexibly Scheduled Course	Never
Does any section of this course have a distance education component?	No
Grading Basis	Letter Grade
Repeatable	No
Course Components	Lecture
Grade Roster Component	Lecture
Credit Available by Exam	No
Admission Condition Course	No
Off Campus	Never
Campus of Offering	Columbus

Prerequisites and Exclusions

Prerequisites/Corequisites	Prereq or concur: Math 1141, 1151, 1154, 1156, 1161, 1181H, or 4181H
Exclusions	Not open to students with credit for Astronomy 1221
Electronically Enforced	Yes

Cross-Listings

Cross-Listings

Subject/CIP Code

Subject/CIP Code	40.0201
Subsidy Level	Baccalaureate Course
Intended Rank	Freshman, Sophomore

Requirement/Elective Designation

Required for this unit's degrees, majors, and/or minors

Course Details

Course goals or learning objectives/outcomes

- Goal A: Students will understand the fundamentals of astronomical observations across three data types: Spectroscopy, Time Series Analysis and Image Analysis
- Goal B: Students will master fundamental astronomical coordinate systems, units, and time standards
- Goal C: Students will extract physical parameters from astronomical observations using basic fitting methods
- Goal D: Students will work with real astronomical data from surveys and archives
- Goal E: Students will develop computational skills for astronomical data analysis
- Goal F: Students will adopt reproducible research practices for observational astronomy
- Goal G: Students will develop fluency with modern AI tools in astronomical contexts

Content Topic List

- Week 1: Introduction to Modern Astronomical Computing
- Week 2: Working with Astronomical Data Files
- Week 3: Functions, Classes, and Astronomical Visualization
- Week 4: AI Tools for Astronomical Research
- Week 5: Professional Development and Deployment
- Week 6: Project 1 Presentations
- Week 7: Astronomical Catalog Analysis with Pandas
- Week 8: Astropy Fundamentals – Coordinates, Units, and Archives
- Week 9: Solar System Observations and Ephemerides
- Week 10: Numerical Methods for Astronomical Analysis
- Week 11: Project 2 Presentations
- Week 12: Model Fitting for Astronomical Data
- Weeks 13–14: Domain-Specific Astronomical Analysis

Sought Concurrence

No

Attachments

- Astronomy_2250_Syllabus.docx: syllabus word doc

  (Syllabus. Owner: Westraadt,Lindsay)
- Astronomy_2250_Syllabus.pdf: syllabus pdf

  (Syllabus. Owner: Westraadt,Lindsay)
- AstronomyCurriculumMap.xlsx: curriculum map

  (Other Supporting Documentation. Owner: Westraadt,Lindsay)
- Rationale.docx: rationale

  (Cover Letter. Owner: Westraadt,Lindsay)
- Astronomy_2250_Syllabus UPDATED.docx: syllabus word doc - Contingency addressed

  (Syllabus. Owner: Westraadt,Lindsay)
- Astronomy_2250_Syllabus UPDATED.pdf: syllabus pdf - Contingency addressed

  (Syllabus. Owner: Westraadt,Lindsay)

Comments

- Please see subcommittee feedback email sent 1/23/26. *(by Neff,Jennifer on 01/23/2026 12:44 PM)*
- Currently, the foundations of astronomical observation and computational analysis are not covered by any required major course. Students gain some skills either through an introductory programming course (CSE 122x) or a legacy GE course in astronomical data analysis (ASTRON 1221), with most choosing ASTRON 1221. CSE 122x does not provide the observational or data analysis foundations needed for ASTRON 3350, limiting time for advanced content. ASTRON 1221 does not fully develop the astronomical observation or observation computational skills at the level required for astronomy majors. Neither course meets OSU's new AI fluency outcomes in an astronomical context. ASTRON 2250 fills this gap by aligning observational and data analysis learning outcomes with institutional AI goals and workforce trends. It elevates ASTRON 1221 to offer more comprehensive observational methods, stronger computational training, and AI fluency, ensuring graduates remain competitive in an AI-driven workforce. *(by Westraadt,Lindsay on 12/01/2025 12:09 PM)*

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Westraadt,Lindsay	12/01/2025 12:13 PM	Submitted for Approval
Approved	Thompson,Todd Alan	12/01/2025 01:00 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	12/01/2025 03:39 PM	College Approval
Revision Requested	Neff,Jennifer	01/23/2026 12:44 PM	ASCCAO Approval
Submitted	Westraadt,Lindsay	01/23/2026 01:33 PM	Submitted for Approval
Approved	Thompson,Todd Alan	01/23/2026 01:38 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/23/2026 03:07 PM	College Approval
Revision Requested	Neff,Jennifer	01/24/2026 01:41 PM	ASCCAO Approval
Submitted	Westraadt,Lindsay	01/24/2026 02:26 PM	Submitted for Approval
Approved	Thompson,Todd Alan	01/24/2026 03:04 PM	Unit Approval
Approved	Vankeerbergen,Bernadette Chantal	01/26/2026 02:32 PM	College Approval
Pending Approval	Jenkins,Mary Ellen Bigler Neff,Jennifer Vankeerbergen,Bernadette Chantal Wade,Macy Joy Steele,Rachel Lea	01/26/2026 02:32 PM	ASCCAO Approval

Rationale:

Currently, the foundations of astronomical observation and computational analysis are not covered by any required major course. Students gain some skills either through an introductory programming course (CSE 122x) or a legacy GE course in astronomical data analysis (ASTRON 1221), with most choosing ASTRON 1221. CSE 122x does not provide the observational or data analysis foundations needed for ASTRON 3350, limiting time for advanced content. ASTRON 1221 does not fully develop the astronomical observation or observation computational skills at the level required for astronomy majors. Neither course meets OSU's new AI fluency outcomes in an astronomical context. ASTRON 2250 fills this gap by aligning observational and data analysis learning outcomes with institutional AI goals and workforce trends. It elevates ASTRON 1221 to offer more comprehensive observational methods, stronger computational training, and AI fluency, ensuring graduates remain competitive in an AI-driven workforce.

Astronomy 2250: Foundations of Astronomical Observation and Data Analysis

Syllabus for [Semester Year]

Course Information

Course Number: Astronomy 2250

Course Title: Foundations of Astronomical Observation and Data Analysis

Credit Hours: 3

Format of Instruction: In-person lectures with hands-on coding sessions, 2 meetings per week (80 minutes each)

Web Page: Available through http://carmen.osu.edu

Prerequisites or Corequisites: Math 1141, 1151, 1154, 1156, 1161, 1181H, or 4181H

Exclusions: Not open to students with credit for Astronomy 1221

Course Description

Astronomy 2250 introduces students to the fundamentals of observational astronomy through computational data analysis. The primary focus is on learning core observational astronomy concepts: working with the three fundamental data types (spectra, time series, and images), understanding astronomical coordinate systems and time standards, measuring physical properties from observations, and extracting scientific results from real astronomical data. All of these concepts will be taught in conjunction with an introduction to the essential programming skills and tools employed in modern astronomy.

Students will master the observational astronomy toolkit including astronomical units and coordinate transformations, multi-wavelength photometry and spectroscopy, time-domain astronomy and variability analysis, image processing and source detection, and basic statistical methods for parameter extraction. Through hands-on projects using real datasets from major surveys and observatories, students will learn to analyze stellar spectra, detect exoplanet transits in light curves, measure proper motions and distances, perform photometry on images, and fit physical models to extract astrophysical parameters.

The course will introduce students to basic concepts in modern machine learning and AI tools, and teach students to leverage Large Language Models as coding assistants while maintaining the critical astronomical reasoning necessary to validate results against physical theory. By course completion, students will understand the fundamentals of how astronomical observations are processed and analyzed, be prepared to work with data from modern surveys, and possess the computational skills to conduct independent observational astronomy research.

Required Materials and Course Resources

All course materials will be provided free of charge through Carmen. Students will need access to:

Required Software (all free):

- Python environment with Anaconda distribution
- Jupyter notebooks for computational work
- Integrated Development Environment
- GitHub account for version control
- Access to Large Language Models (built into some IDEs; additional chatbot access recommended)

Computing Requirements:

- Personal computer (laptop or desktop) compatible with Ohio State's minimum technology recommendations (see https://it.osu.edu/help/it-students/get-tech-ready)
- 10GB available storage for astronomical datasets and software
- Stable internet connection for accessing online astronomical archives
- Web browser for AI tools and online platforms

Course Materials:

- Lecture notes and Jupyter notebooks (provided via Carmen)
- No textbook purchase required

Course Goals and Expected Learning Outcomes

This course develops foundational knowledge of observational astronomy through computational analysis, with programming taught as a tool to understand astronomical observations.

Goal A: Students will understand the fundamentals of astronomical observations across three data types

1. **Spectroscopy:** Students will understand spectral continuum and line formation, perform continuum normalization and line identification, measure radial velocities through template matching, determine equivalent widths, and derive basic stellar parameters from spectra
2. **Time Series Analysis:** Students will analyze light curves to detect periodic variability, apply periodogram techniques to find periods, phase-fold data to characterize signals, fit transit models to extract planetary parameters, and understand time-domain phenomena (eclipsing binaries, pulsating stars, exoplanets)
3. **Image Analysis:** Students will understand astronomical image structure and backgrounds, perform source detection and characterization, apply basic PSF and aperture photometry techniques, measure astrometric positions, and extract photometric measurements from survey images

Goal B: Students will master fundamental astronomical coordinate systems, units, and time standards

1. Students will work with astronomical coordinate systems (equatorial, galactic, ecliptic) and perform transformations between them
2. Students will understand and apply astronomical units, distance scales (parallax, distance modulus), and the magnitude system

3. Students will work with astronomical time systems (UTC, TT, TDB, Julian Dates) and understand their applications
4. Students will perform coordinate-based cross-matching and calculate angular separations
5. Students will use physical and astronomical constants in calculations with proper dimensional analysis

Goal C: Students will extract physical parameters from astronomical observations using basic fitting methods

1. Students will measure stellar properties from photometric observations (colors, absolute magnitudes, temperatures, distances)
2. Students will fit physical models to observational data (orbits, transits, light curves, spectral lines) using standard techniques
3. Students will derive planetary parameters from transit photometry (radius, period, orbital properties)
4. Students will measure stellar kinematics (proper motions, radial velocities, space velocities)
5. Students will apply basic statistical methods to assess measurement uncertainties and fit quality

Goal D: Students will work with real astronomical data from surveys and archives

1. Students will query major astronomical databases (VizieR, SIMBAD, NED, MAST) programmatically
2. Students will work with standard astronomical data formats (FITS images and tables, astronomical catalogs)
3. Students will process and analyze multi-wavelength photometric data
4. Students will handle large datasets from surveys efficiently
5. Students will build complete analysis pipelines from raw observations to scientific results

Goal E: Students will develop computational skills for astronomical data analysis

1. Students will write Python code to process and analyze astronomical observations
2. Students will use essential astronomical libraries (Astropy, Astroquery) for data analysis
3. Students will apply basic numerical methods (interpolation, integration, optimization) to astronomical problems
4. Students will create publication-quality visualizations of astronomical data
5. Students will effectively leverage AI tools as coding assistants while maintaining critical astronomical reasoning

Goal F: Students will adopt reproducible research practices for observational astronomy

1. Students will use version control (Git/GitHub) for research code management
2. Students will document analysis workflows clearly and create reproducible pipelines
3. Students will validate computational results against astronomical theory and observations
4. Students will collaborate effectively on team projects using modern development tools
5. Students will build shareable astronomical tools and deploy them for community use

Goal G: Students will develop fluency with modern AI tools in astronomical contexts

1. Students will define key concepts such as machine learning, artificial intelligence, and Large Language Models
2. Students will understand how machine learning, AI, and LLMs are transforming core astronomical functions such as coding, writing, data analysis, and research workflows; examine their strengths and limitations; and recognize the evolving role of researchers in each context
3. Students will use LLMs effectively as coding assistants for astronomical programming tasks
4. Students will critically evaluate AI-generated code and results against physical and astronomical expectations

Grading Information

Assessment Breakdown

- Weekly Homework Assignments: 40%
- Project 1 (AI/LLM Integration): 20%
- Project 2 (Data Wrangling & Analysis): 20%
- Project 3 (Data Fitting): 20%

Weekly Homework Assignments (40%)

Starting from Week 2, students will complete individual weekly homework assignments that reinforce lecture material and build foundational skills. Assignments will include:

- Astronomical concept problems (coordinate systems, time standards, observational techniques)
- Order-of-magnitude calculations and scaling relations (planetary masses, orbital velocities, light travel times)
- Code interpretation and debugging exercises
- Short coding tasks applying concepts to astronomical data
- Problem-solving scenarios with observational data

Submission: Homework is due before the first lecture of the following week via Carmen.

Late Policy: Assignments submitted up to 48 hours late will receive a 20% penalty. Assignments more than 48 hours late will not be accepted without prior arrangement.

Collaboration Policy: Students may discuss concepts with classmates but must write and submit their own solutions independently. All submitted code must be the student's own work.

Project 1: AI/LLM Integration Project (20%) – Week 6

Format: Paired project (teams of two; one group of three if needed)

Length/Scope: Complete Jupyter notebook with 200+ lines of code and 1000+ words of documentation

Focus: Building AI-enhanced astronomical tools or analyses using Python fundamentals and LLM integration

Students will create practical astronomical applications demonstrating proficiency with programming fundamentals (Weeks 1–4) applied to astronomy problems. Projects may range from AI-powered observation planning tools to interactive catalogs with natural language queries. Example projects include: building LLM-assisted exoplanet databases with natural language search, creating AI-powered Messier object observing guides, developing stellar parameter estimators with conversational interfaces, or building astronomical fact-checkers that validate claims against observational data.

Deliverables:

- Complete Jupyter notebook with code, documentation, and astronomical context
- In-class presentation (10 minutes): problem motivation, implementation, demonstration, Q&A
- Individual contribution statement
- Optional: GitHub repository (0.5 bonus points)

Grading Criteria:

- Code quality and organization (30%): proper structure, documentation, error handling
- Technical implementation (30%): appropriate use of programming concepts, LLM integration
- Astronomical application (20%): meaningful astronomy problem, correct physical reasoning
- Presentation (20%): clear communication, demonstration, time management

Both partners must contribute equally and will receive the same grade unless significant disparities are documented.

Project 2: Data Wrangling & Analysis Project (20%) – Week 11

Format: Paired project

Length/Scope: Complete Jupyter notebook with substantial data processing, GitHub repository required

Focus: Pandas data manipulation combined with either AI integration (LLM + Function Tools) OR astronomical computing (Astropy + Skyfield)

Students will work with real astronomical datasets to build complete data processing pipelines. Projects emphasize data acquisition from archives, catalog cross-matching, exploratory analysis, and deriving physical parameters. Example projects include: analyzing exoplanet populations from NASA archive, building ISS visibility predictors with observation logging, creating lunar phase calendars correlated with events, generating solar system dashboards, organizing JWST observation catalogs, exploring stellar populations from Gaia, or analyzing Messier object observing conditions.

Deliverables:

- Jupyter notebook with complete analysis and interpretation
- GitHub repository with proper documentation, version control, and requirements.txt
- In-class presentation (10 minutes)
- Individual contribution statement

Grading Criteria:

- Data processing quality (30%): catalog handling, cross-matching, derived quantities
- Technical implementation (25%): proper use of Pandas and astronomical libraries
- Physical interpretation (20%): astronomically meaningful results and insights
- GitHub repository (10%): professional documentation and structure
- Presentation (15%): clear communication and demonstration

Project 3: Data Fitting Project (20%) – Weeks 15–16

Format: Paired capstone project

Length/Scope: Complete fitting pipeline with statistical analysis, written report following journal format

Focus: Applying model fitting techniques to extract physical parameters from one of three astronomical data types

Students choose from three domains:

1. **Spectral Analysis:** Continuum fitting, spectral line identification and measurement, radial velocity determination via cross-correlation, equivalent width measurement, abundance derivation
2. **Image Analysis:** Background modeling and subtraction, source detection, PSF/aperture photometry, fitting point sources, analyzing crowded fields
3. **Time Series Analysis:** Period detection with Lomb-Scargle periodograms, phase-folding techniques, fitting transit models or eclipsing binary light curves, extracting orbital/planetary parameters

Example projects include: measuring orbital decay in binary pulsars (testing general relativity), determining black hole masses from stellar orbits, detecting the first exoplanet from radial velocities, fitting Hubble diagrams from supernovae (dark energy), measuring Cepheid period-luminosity relations, extracting exoplanet radii from Kepler transits, or performing PSF photometry on star clusters.

Deliverables:

- Complete fitting pipeline (Jupyter notebook) demonstrating scipy.optimize implementation

- Written report (1000+ words) with sections: scientific motivation, data description, model description, fitting methodology, results and uncertainties, physical interpretation, discussion
- GitHub repository with professional documentation
- In-class presentation (10 minutes): background, data, methods, results, interpretation, Q&A

Grading Criteria:

- Technical implementation (30%): custom model functions, proper use of scipy.optimize, uncertainty estimation
- Statistical analysis (25%): chi-squared calculation, residual analysis, goodness-of-fit assessment
- Physical interpretation (20%): astronomically meaningful parameter extraction, comparison to theory
- Documentation (10%): clear workflow explanation, GitHub repository
- Presentation (15%): effective communication of science and methods

Grading Scale

Grade	Percentage
A	93–100
A-	90–92.9
B+	87–89.9
B	83–86.9
B-	80–82.9
C+	77–79.9
C	73–76.9
C-	70–72.9
D+	67–69.9
D	60–66.9
E	Below 60

Weekly Course Outline

The course progresses from Python fundamentals through advanced astronomical data analysis, integrating astronomical content from the start. Students learn the three fundamental observational data types (spectra, time series, images) and core astronomical concepts (coordinates, time systems, units) throughout.

Week 1: Introduction to Modern Astronomical Computing

Lecture 1: Welcome and Course Overview

- Course overview: computational skills in modern observational astronomy
- The three pillars of astronomical observations: spectra, time series, images
- Introduction to astronomical scales: distances, masses, timescales in the universe
- Introduction to Large Language Models as research tools

- Setting up the Python environment and development tools

Lecture 2: Data Types for Astronomical Calculations

- Variables and operations for astronomical calculations (distances, magnitudes, fluxes)
- Strings and formatting for astronomical output (coordinates, object names)
- Lists and tuples for organizing observational data
- Dictionaries for catalog-style data structures
- Understanding errors and debugging basics

Week 2: Working with Astronomical Data Files

Lecture 3: Control Flow and Astronomical Data Files

- Conditional statements and logical operators for data quality filtering
- Loops for processing multiple observations
- Exception handling for robust data processing
- File I/O with formats common to astronomy (CSV, text, JSON)
- File system operations for managing observation logs and datasets

Lecture 4: Numerical Computing for Astronomy

- Arrays for efficient astronomical calculations
- Vectorized operations: computing magnitudes, colors, and distances for catalogs
- Boolean masks for source selection (e.g., by brightness, color, position)
- Array statistics: measuring properties of stellar populations
- Handling missing data in astronomical observations

Week 3: Functions, Classes, and Astronomical Visualization

Lecture 5: Building Reusable Astronomical Tools

- Functions for astronomical calculations (coordinate conversions, magnitude systems)
- Organizing code into modules for reuse
- Classes and objects for astronomical data structures (e.g., Star, Observation, Catalog)
- Documenting astronomical code effectively

Lecture 6: Visualizing Astronomical Data

- Matplotlib fundamentals for astronomical plots
- Color-magnitude diagrams and H-R diagrams
- Light curves and time series visualization
- Image display with appropriate scaling and colormaps
- Creating publication-quality figures with proper labels and units

Week 4: AI Tools for Astronomical Research

Lecture 7: Using LLMs as Coding Assistants

- Effective prompting for astronomical coding tasks
- Chain-of-thought reasoning for complex astronomical problems

- Structured data extraction from astronomical sources
- Vision models for astronomical image description
- Critical evaluation of AI-generated code

Lecture 8: Building AI-Enhanced Astronomical Tools

- Function tools: extending LLMs with astronomical calculations
- Retrieval Augmented Generation for astronomical literature
- Document processing and knowledge extraction
- Building conversational interfaces for astronomical data

Week 5: Professional Development and Deployment

Lecture 9: Version Control for Astronomical Research

- Git and GitHub fundamentals for research code
- Creating and managing repositories
- Writing documentation for astronomy projects
- Collaboration workflows for research teams

Lecture 10: Sharing Astronomical Tools

- Building interactive astronomical applications
- Creating user interfaces for data exploration
- Deploying tools for community use
- Portfolio development for astronomical computing

Week 6: Project 1 Presentations

AI/LLM Integration Projects

Week 7: Astronomical Catalog Analysis with Pandas

Lecture 11: Working with Astronomical Catalogs

- DataFrames for astronomical catalog data
- Loading and exploring survey catalogs
- Selecting sources by observational criteria (magnitude, color, position)
- Data quality assessment and validation
- Computing derived quantities (colors, absolute magnitudes, distances)

Lecture 12: Advanced Catalog Operations

- Groupby operations for stellar population analysis
- Cross-matching catalogs from different surveys
- Combining multi-wavelength observations
- Time series operations for light curve analysis

Week 8: Astropy Fundamentals – Coordinates, Units, and Archives

Lecture 13: Astronomical Coordinates and Units

- Querying astronomical databases (VizieR, SIMBAD, NED)
- The Astropy units system for dimensional analysis
- Physical and astronomical constants
- Coordinate systems: equatorial (RA/Dec), galactic, ecliptic
- Coordinate transformations and cross-matching
- Angular separations and proper motions

Lecture 14: Time Systems, Observation Planning, and FITS Files

- Astronomical time systems: UTC, TT, TDB, Julian Dates
- Barycentric corrections for precision timing
- Observation planning: airmass, visibility, Moon avoidance
- FITS file format: the standard for astronomical data
- Working with FITS images and tables
- World Coordinate System (WCS) for astrometry

Week 9: Solar System Observations and Ephemerides

Lecture 15: Precision Ephemerides for Solar System Astronomy

- High-precision planetary positions and motions
- Rise, set, and transit calculations
- Twilight, Moon phases, and observing conditions
- Satellite tracking and planetary observation planning
- Eclipse and occultation prediction

Week 10: Numerical Methods for Astronomical Analysis

Lecture 16: Interpolation and Integration

- Interpolating sparse astronomical data
- Handling periodic data (orbital phases, rotation)
- Numerical differentiation and integration
- Applications to orbital mechanics and light curves

Lecture 17: Statistical Methods for Observations

- Probability distributions in astronomy
- Combining measurements and weighted averaging
- Outlier detection with sigma clipping
- Distribution fitting and model comparison

Week 11: Project 2 Presentations

Data Wrangling and Analysis Projects

Week 12: Model Fitting for Astronomical Data

Lecture 18: Optimization and Curve Fitting

- Cost functions and chi-squared minimization
- Linear fitting: stellar proper motions, period-luminosity relations
- Non-linear fitting: variable stars, binary orbits, exoplanet transits
- Parameter uncertainties and error propagation
- Assessing fit quality: residuals and reduced chi-squared

Weeks 13–14: Domain-Specific Astronomical Analysis

Lecture 19: Time Series Analysis – Exoplanet Transits and Variable Stars

- Time-domain astronomy fundamentals
- Period detection with Lomb-Scargle periodograms
- Phase folding techniques
- Transit model fitting and planetary parameter extraction
- Eclipsing binary and pulsating star analysis

Lecture 20: Image Analysis – Photometry and Astrometry

- Astronomical image structure and backgrounds
- Source detection and characterization
- PSF and aperture photometry techniques
- Crowded field photometry
- Astrometric measurements from images

Lecture 21: Spectroscopic Analysis – Stellar Parameters and Kinematics

- Spectral line profiles and continuum normalization
- Radial velocity measurement via cross-correlation
- Equivalent widths and abundance analysis
- Deriving stellar parameters: temperature, gravity, metallicity
- Multi-line fitting and blended features

Week 15: Advanced AI Integration

Lecture 22: The Future of AI in Astronomical Research

- Standardized protocols for AI-tool integration
- Building automated astronomical workflows
- AI-assisted data reduction pipelines
- The evolving role of astronomers in the AI era

Weeks 15–16: Final Project Presentations

Project 3: Data Fitting Projects

University Policies and Statements

For complete information on university policies and statements, please visit the [Office of Undergraduate Education's Syllabus Policies & Statements webpage].

			Astronomy & Astrophysics Major Learning Goals					
		Credits	Acquire a basic mastery of fundamental physics and astrophysics, including motion and structure through classical mechanics, electromagnetism, and modern physics	Develop analytical and problem solving skills involving physics and mathematics	Acquire a basic mastery of experimental methods	Acquire a basic mastery of data analysis and AI fluency	Learn to effectively communicate professionally and colloquially (orally and in writing)	Learn about and participate in research and outreach activities consistent with their interest, ability, and postgraduate plans
Required Courses (offered by the unit)	Astron 2895: Seminar	1					beginning	beginning
	Astron 2250: Foundations of Observation	3	beginning	intermediate	intermediate	intermediate	intermediate	
	Astron 2291: Intro Astrophys I	3	advanced	advanced				
	Astron 2292: Intro Astrophys II	3	advanced	advanced				
	Astron 3350: Methods of Observation	3	beginning	advanced	advanced	advanced	advanced	intermediate
Required 5000-level course (pick one)	Astron 5205: Planetary Science	3	advanced	advanced	intermediate			
	Astron 5681: Stellar Evolution	3	advanced	advanced	beginning			
	Astron 5682: Cosmology	3	advanced	advanced	beginning			
Required Courses (offered outside the unit)	Math 2415: ODEs and PDEs	3		advanced				
	Math 2568: Linear Algebra	3		advanced				
	Physics 2300: Mechanics I	4	advanced	advanced	beginning			
	Physics 2301: Mechanics II	4	advanced	advanced	beginning			
	Physics 3700: Data Analysis Lab	3	beginning	advanced	advanced	advanced	advanced	beginning
	Physics 5400: Int. E&M I	4	advanced	advanced				
	Physics 5500: Quan. Mech I	4	advanced	advanced				
	Physics 5600: Stat Mech	4	advanced	advanced				
Only one of these is required	Physics 5401: Int. E&M II	4	advanced	advanced				
	Physics 5501: Int E&M II	4	advanced	advanced				