San Diego State University

Bachelor of Science Degree, Department of Astronomy

Program Mission

The Bachelor of Sciences degree in Astronomy is intended to provide a strong background in the field of astronomy and the research skills that will help the student go on to do research work in the physical sciences. Students that intend to pursue advanced degrees in the physical sciences would be best served by this major.

What follows are the Program Learning Goals (PLGs), Degree Learning Outcomes (DLOs), and Curricular MAP that lead to the *Bachelor of Science* degree in Astronomy.

Program Learning Goals (PLGs)

- PLG-1: Apply physical principles

  Apply physics concepts to the investigation of scientific questions in cosmology; galaxies, galactic structure, and the interstellar medium; star formation, stellar structure and evolution; and solar system components and their evolution.

- PLG-2: Investigate astronomical theories

  Develop a conceptual understanding of the major theories describing the formation, evolution, and destruction of astronomical entities (the solar system, stars, galaxies, and the universe), and investigate the observational evidence related to these theories.

- PLG-3: Critically evaluate scientific information

  Critically evaluate and interpret quantitative astronomical information (including observational data and computer models) within the framework of the scientific method.

- PLG-4: Communicate scientific information

  Effectively communicate scientific ideas in oral or written forms.

- PLG-5: Develop research skills

  Develop the technical, computational, and analytical skills needed to pursue an individualized research project.

Degree Learning Outcomes (DLOs)

- DLO-1: Apply scale arguments

  Apply the concepts of time, length, mass, and energy scales to understand the most important physical processes at work in different parts of the Universe.

- DLO-2: Critique the distance scale

  Identify the techniques that are used to measure the distances to different astronomical objects, explain the conceptual basis for each measurement method (such as trigonometry, standard candles, standard rulers, and the Hubble Law), and evaluate how they are assembled to produce a distance scale covering all astronomical objects.

- DLO-3: Describe the interactions of electromagnetic radiation

  Identify the origins of various forms of electromagnetic radiation, and describe the physical principles behind the interactions between radiation and matter (including astronomical detectors).

- DLO-4: Demonstrate a working knowledge of gravitation

  Demonstrate a working knowledge of gravitation by calculating the characteristics of an orbit or the mass involved.

- DLO-5: Evaluate star and planet formation theory

  Enumerate the steps of the theory that stars and planets form from large interstellar gas clouds, explain the physics justifying each step, and evaluate the theory by examining evidence collected from the solar system, other star systems, and gas clouds.

- DLO-6: Evaluate stellar evolution theory

  Examine the construction of theoretical models of stars from physical principles, and compare models to the observed characteristics of stars.

- DLO-7: Evaluate Big Bang theory

  Identify the evidence that led to a picture of an expanding universe, utilize physical principles to assemble a history of the evolution of the early universe, and explain how these lead to testable predictions about the universe's history and future.

- DLO-8: Explain research motivation

  Explain the motivation and goals for a research project in clear language.

- DLO-9: Use astronomical tools

  Use astronomical instruments (such as telescopes and detectors) to collect observational data. Demonstrate the analytical skills required to construct a theoretical model.

- DLO-10: Analyze observational data

  Calibrate, analyze, and model observational data in order to test appropriate theories, and undertake theoretical calculations to describe existing data.

- DLO-11: Assess uncertainties in data

  Assess the uncertainties in observational data or numerical simulations to evaluate the potential to successfully address a scientific question.

- DLO-12: Draw sound conclusions from evidence

  Draw sound conclusions from observational evidence or theoretical arguments.

- DLO-13: Express scientific arguments in astronomy

  Express effective scientific arguments in written or oral form, to professional scientists or to the general public.

Curricular Map: Bachelor of Science Degree in Astronomy

The following Table lists the courses currently offered by the Department of Astronomy that are applicable to the Bachelor of Science Degree in Astronomy (see the SDSU General Catalog for specific requirements), along with the Degree Learning Outcomes (DLOs) that are (I)ntroduced, (P)racticed, and/or (D)emonstrated in each course.

Table 1. Curricular MAP for the Bachelor of Science Degree in Astronomy

Course	DLO-1	DLO-2	DLO-3	DLO-4	DLO-5	DLO-6	DLO-7	DLO-8	DLO-9	DLO-10	DLO-11	DLO-12	DLO-13
ASTR 201: Astr. Sci.	IPD	I	IPD	IPD	IPD	I	IPD					I	I
ASTR 320: Sol. Sys.	IPD	IPD	IPD	IPD	IPD	IPD		IPD				IPD	IPD
ASTR 350: Astr. Tech.	PD	IPD	I D		D			IPD	IPD	IPD	IP	P	PD
ASTR 440: Stars	P	P	PD	P	P	PD		PD		PD		P	PD
ASTR 450: Star Sys.	IPD	IPD	IPD	IPD	I	I	IPD					IPD	IPD
ASTR 498: Snr. Proj.			PD					PD	PD	D	IPD	PD	D
ASTR 510: Exoplanets					IPD			I	IPD	IPD	IPD		

Note. — I=Introduced; P=Practiced; D=Demonstrated