Program Mission

The Master of Science (MS) degree in Astronomy is designed to prepare students either for further graduate work leading to the doctorate, or for a professional career in teaching or in industry. All students will complete coursework in astronomy and closely related fields, and then complete either a written thesis (“Plan A”) or pass a comprehensive examination (“Plan B”).

What follows are the Program Learning Goals (PLGs), Degree Learning Outcomes (DLOs), and Curricular MAP that lead to the Master of Science degree in Astronomy. The PLGs and DLOs for Plan A and Plan B are identical except that Plan B does not include PLG-5.

Program Learning Goals (PLGs)

- PLG-1: Apply physical principles
  Apply physics to the investigation of scientific questions in cosmology; galaxies; galactic structure and evolution; stellar atmospheres and interiors; and astronomical observing and data analysis techniques.

- PLG-2: Investigate astronomical theories
  Develop a conceptual understanding of the major theories describing the formation, evolution, and fate of astronomical entities (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 and written forms.

- PLG-5: Develop research skills
  Develop the technical, computational, and analytical skills needed to pursue an individualized research project and/or be able to critically read and evaluate the merits of published research.
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, standard sirens, 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
  Apply quantitative Newtonian gravitational principles to the study of stars, galaxies, and cosmology. Demonstrate a qualitative understanding of the implications that general relativistic principles have when interpreting the foundational equations of cosmology.

• 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 galaxy formation theory
  Enumerate the steps of the theory that galaxies form from overdensities in the early universe, explain the physics justifying each step, and evaluate the theory by examining evidence collected from local and high-redshift galaxies and the intergalactic medium.
• DLO-8: 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. Construct
  an argument based on astronomical evidence that the universe has evolved from a
  hot, dense state. Present the currently favored scientific theory for what the ultimate
  fate of our universe will be, and outline the astronomical observations upon which it
  is based.

• DLO-9: Explain research motivation
  Explain the motivation and goals for a research project in clear language.

• DLO-10: Use astronomical tools
  Use astronomical instruments (such as telescopes and detectors) to collect observa-
  tional data, or demonstrate the analytical skills required to undertake a theoretical
  model, or both.

• DLO-11: Analyze observational data
  Calibrate, analyze, and model observational data in order to test appropriate theories,
  or undertake theoretical calculations to describe existing data.

• DLO-12: Assess uncertainties in data
  Assess the uncertainties in observational data or numerical simulations to evaluate
  the potential to successfully address a scientific question.

• DLO-13: Draw sound conclusions from evidence
  Draw sound conclusions from observational or theoretical evidence.

• DLO-14: Present current astronomical research advances
  Be able to create and give an oral presentation that clearly demonstrates advanced
  understanding of a current research topic in astronomy.

**Curricular Map: Master of Science Degree in Astronomy**

The following Table lists the courses currently offered by the Department of Astronomy
that are applicable to the Master of Science Degree in Astronomy (see the current SDSU
Graduate Bulletin for specific requirements), along with the Degree Learning Outcomes
(DLOs) that are (I)ntrroduced, (P)racticed, and/or (D)emonstrated in each course.
Table 1. Curricular MAP for the Master of Science Degree in Astronomy

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<th>Course</th>
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Note. — I=Introduced; P=Practiced; D=Demonstrated