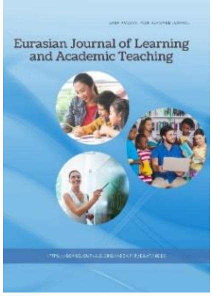


# Research objects of astrophysics as well as some methods of studying

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**ABSTRACT**

This article is about the use of physics to determine the nature of astronomical objects and determine their positions and motions and about several methods for studying astrophysical objects. As astrophysics is a very broad subject, astrophysicists apply concepts and methods from many disciplines of physics, including classical mechanics, electromagnetism, statistical mechanics, thermodynamics, quantum mechanics, relativity, nuclear and particle physics, and atomic and molecular physics. In practice, modern astronomical research often involves a substantial amount of work in the realms of theoretical and observational physics. Some areas of study for astrophysicists include their attempts to determine the properties of dark matter, dark energy, black holes, and other celestial bodies; and the origin and ultimate fate of the universe.

**Keywords:** Sun, nuclear physics, particle physics, stars, galaxies, extrasolar planets, dark matter, dark energy, black holes, the interstellar medium, the cosmic microwave background, atomic physics, molecular physics, emissions, electromagnetic spectrum, luminosity, density, temperature, chemical composition.

While astronomy is one of the oldest sciences, theoretical astrophysics began with Isaac Newton.

Prior to Newton, astronomers described the motions of space objects as they were then called, using complex mathematical models without a physical basis. Newton showed a single theory, describing what we now know as gravity, simultaneously explains the orbits of moons and planets in space and the trajectory of a core on Earth. This added to the objects of evidence for the startling conclusion that the space and Earth are subject to the same physical laws.

Perhaps what most separated Newton's model from previous concepts, is that his theory was predictive as well as descriptive. Based on deviations in the orbit of Uranus, astronomers predicted the position of a new planet, which was then discovered and named Neptune. [1]

Astrophysics is a science that employs the methods and principles of physics and chemistry in the study of astronomical objects and phenomena. As one of the founders of the discipline, James Keeler, said, Astrophysics "seeks to ascertain the nature of the space object rather than their positions or motions in space–what they are, rather than where they are."[3] Subjects studied include the Sun, other stars, galaxies, extrasolar planets, the interstellar medium, and cosmic microwave radiation. The emissions of these objects are studied in all parts of the electromagnetic spectrum, and the studied characteristics include luminosity, density, temperature and chemical composition Astrophysicists seek to understand the universe and our place in it.

At NASA, the aims of its astrophysics work are "to discover how the universe works, explore how it began and evolved, and search for life on planets around other stars," according to NASA's website.

Astronomical science is broadly divided into 2 sections:

- Observational astrophysics
- Theoretical astrophysics

**Observational Astrophysics**

- In contrast to theoretical astrophysics, which is primarily concerned with determining the observable consequences of physical models, observational astronomy is a branch of astronomical science concerned with collecting and interpreting data.
- It is the method of using telescopes and other astronomical instruments to observe celestial objects.
- The electromagnetic spectrum is used in the majority of astrophysical observations.
- The various branches of Observational Astrophysics are as follows:

1. Radio astronomy is the study of electromagnetic radiation with a wavelength of more than a few millimetres. Radio waves, which are normally produced by cold objects including interstellar gas and dust clouds; cosmic microwave background radiation, which is redshifted light from the Big Bang; and pulsars, which were first observed at microwave frequencies, are all examples of research areas. The detection of these waves requires the use of extremely large radio telescopes.

2. Infrared astronomy is the study of radiation with a wavelength too long to be seen with the naked eye but shorter than radio waves. Observations in the infrared are usually produced with telescopes that are close to optical telescopes.

3. The earliest form of astronomy was optical astronomy. The most popular instruments used are telescopes with charge-coupled devices or spectroscopes. Since optical observations are hampered by the Earth's atmosphere, adaptive optics and space telescopes are used to achieve the best image quality possible. Stars are highly visible in this wavelength range, and several chemical spectra can be studied to study the chemical composition of stars, galaxies, and nebulae.

4. Extremely energetic processes such as binary pulsars, black holes, magnetars, and many others are studied in ultraviolet, X-ray, and gamma-ray astronomy. These types of radiation have a hard time penetrating the Earth's atmosphere. To detect this portion of the electromagnetic spectrum, two technologies are used: space-based telescopes and ground-based imaging air Cherenkov telescopes (IACT). RXTE, the Chandra X-ray Observatory, and the Compton Gamma Ray Observatory are examples of the first type of observatory. The High Energy Stereoscopic System (H.E.S.S.) and the MAGIC telescope are a few of IACT. [6]

- Aside from electromagnetic radiation, there are few objects that can be seen from the Earth that come from great distances. Although there have been a few gravitational wave observatories built, gravitational waves are extremely difficult to detect.
- Neutrino observatories have also been built, with the aim of studying our Sun.
- Cosmic rays, which are composed of extremely high-energy particles, have been observed striking the Earth's atmosphere.
- The time scale of observations can also differ. Rapidly changing phenomena cannot be detected since most optical measurements take minutes to hours. Some artefacts, however, have historical data spanning centuries or millennia.
- Radio observations, on the other hand, may look at events in milliseconds or combine years of data. The data collected from these various timescales are very different.
- In observational astrophysics, the study of our own Sun holds a special position. Since all other stars are so far away, the Sun can be seen with a level of detail that no other star can match. Our awareness of the Sun acts as a template for learning about other stars.
- The Hertzsprung–Russell diagram, which can be interpreted as describing

the state of a stellar object from birth to death, is often used to model how stars evolve, or stellar evolution.

**Theoretical Astrophysics**

- Though astronomy is one of the oldest sciences, it was Isaac Newton who pioneered theoretical astrophysics.
- Prior to Newton, astronomers used complex mathematical models with no physical basis to explain the movements of celestial bodies.
- Newton demonstrated that the orbits of moons and planets in space and the trajectory of a cannonball on Earth can all be explained by a single theory.
- This added to the growing body of evidence supporting the surprising conclusion that the heavens and the Earth are both subject to the same physical laws.
- Analytical models and computational numerical simulations are among the methods used by theoretical astrophysicists. Each has its own set of benefits.
- Analytical models of a mechanism are usually more effective at revealing the root of the problem.
- Numerical models will uncover events and results that would otherwise go undetected.
- Astrophysics theorists try to come up with theoretical models and then find out what those models mean in terms of observations. This allows observers to search for data that can be used to refute a model or to choose among many competing models.
- Theorists often attempt to create or change models in order to incorporate new data. Where there is an anomaly, the standard practice is to try to match the data with as few changes as possible to the model. A large amount of inconsistent data over time may lead to the complete abandonment of a model in some cases.
- Stellar mechanics and evolution, galaxy formation and evolution, magneto-hydrodynamics, large-scale structure of matter in the universe, the origin of cosmic rays, general relativity, and physical cosmology, including string cosmology and astroparticle physics, are among the topics studied by theoretical astrophysicists.
- Astrophysical theory of relativity is used to assess the properties of large scale systems in which gravitation plays a major role in the physical phenomenon being studied, as well as the foundation for black hole astrophysics and gravitational wave research.
- The Big Bang, cosmic inflation, dark matter, dark energy, and fundamental theories of physics are among the commonly accepted and researched astrophysics theories and models currently included in the Lambda-CDM model.
- In this article, we had a research on what is astrophysics, the history of astrophysics and the divisions of astrophysics.

**Conclusion**

The Astrophysics definition states that "A branch of physics that studies astronomical structures and phenomena using physics methods and principles". In reality, modern astronomical science often entails a significant amount of theoretical and observational events of physics. Astrophysicists are interested in determining the characteristics of dark matter, dark energy, black holes, and other space objects, as well as the universe's origin and ultimate destiny. The origins of astrophysics can be traced back to the emergence of a unified physics in the seventeenth century, in which the same rules applied to space and earth. There were scientists who were trained in both physics and astronomy who had great influence and considered as founders of today's astrophysics research. Students have still been attracted to astrophysics today. Thanks to the Royal Astronomical Society's promotion of the subject and notable educators such as Lawrence Krauss, Subrahmanyan Chandrasekhar, Stephen Hawking, Hubert

Reeves, Carl Sagan, Neil deGrasse Tyson, and Patrick Moore. Appreciation to the efforts of early, late, and current scientists young people are still been interested in studying the history and science of astrophysics.

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