

THE STAGES OF DEVELOPMENT OF THE SCIENCE OF PHYSICS

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Abstract: This article provides a consistent analysis of the historical stages in the development of physics. It examines the evolution of scientific views from ancient natural philosophy to classical mechanics, electromagnetic theory, relativity, quantum physics, and contemporary scientific research. Scientific factors, key scholars, fundamental theories, and their contributions to the advancement of science and technology at each stage are explored.

Keywords: history of physics, classical mechanics, quantum theory, theory of relativity, scientific revolution, universe, matter, scientific method.

Introduction

Physics is the foundation of natural sciences, studying matter and the laws governing its motion. Throughout human history, deep observation, experimentation, and logical generalization gradually led to the formation of physics as an independent science. From ancient philosophical concepts to the scientific revolution of the 15th–17th centuries, the emergence of new theories in the 19th–20th centuries, and the development of cosmology, particle physics, and quantum technologies in the 21st century, physics has followed a complex evolutionary path. Today, physical knowledge forms the basis not only of science, but also of technology, energy systems, space research, electronics, and materials science.

The earliest ideas related to physics can be traced in ancient Egyptian, Indian, and Chinese sources. However, the development of scientific reasoning is mainly associated with Greek thinkers such as Plato, Aristotle, and Democritus.

- Aristotle explained motion as a process caused by force, where nature operates according to an inherent order of movement.

- Democritus proposed that matter is composed of indivisible atoms.

This stage is characterized by a philosophical rather than experimental approach.

Contribution of Medieval and Eastern Scholars

During this period, the preservation and development of scientific knowledge were largely carried out by scholars of the Eastern Renaissance.

- Ibn Sina, Al-Beruni, Ulugh Beg, and Ibn al-Haytham made significant theoretical and experimental contributions in optics, mechanics, and astronomy.

- Ibn al-Haytham proposed the idea that light travels in the form of waves.

This period brought physics closer to experimentation and logical proof.

Classical Mechanics and the Scientific Revolution (16th–17th centuries)

The works of Copernicus, Kepler, Galileo, and Newton separated physics from philosophy and established it as an independent experimental science.

- Galileo placed experiment at the center of the scientific method and formulated the laws of free fall.

- Kepler discovered the laws of planetary motion.
- Newton, in his *Mathematical Principles of Natural Philosophy*, formulated the law of universal gravitation and gave mechanics a mathematical foundation. This period marked the birth of classical mechanics and laid the groundwork for the further development of physics.

Formation of Electromagnetic Theory

In the 18th–19th centuries, the study of electrical phenomena accelerated.

- Ørsted proved the existence of a magnetic field generated by electric current.
- Faraday discovered the phenomenon of electromagnetic induction.
- Maxwell mathematically united these phenomena, forming the electromagnetic theory. This approach paved the way for the development of radio communication, electrical energy systems, and telecommunications.

Theory of Relativity

In the early 20th century, Albert Einstein proposed an alternative to classical mechanics:

- **Special Theory of Relativity (1905):** Explained changes in time, mass, and length at velocities approaching the speed of light.
- **General Theory of Relativity (1915):** Interpreted gravity as the curvature of spacetime. These theories formed the scientific basis for research in cosmology, black holes, and gravitational waves.

Emergence of Quantum Physics

In the 20th century, a completely new scientific paradigm appeared to explain atomic and micro-level phenomena.

- Planck introduced the concept of quanta.
- Bohr developed the atomic model.
- Schrödinger, Heisenberg, and Dirac formulated the mathematical structure of quantum mechanics.

Quantum theory led to the creation of laser technology, semiconductors, and computer microchips.

Modern Directions in Physics

Today, physics is rapidly advancing in several strategic fields:

- Particle physics (Standard Model)
- Quantum computers and quantum artificial intelligence
- String theory and M-theory
- Astrophysics and cosmology
- Nanotechnology

These fields significantly influence scientific progress as well as technological development.

Conclusion

The history of the development of physics reflects the evolution of human thought. From ancient philosophical ideas to the scientific revolution, relativity, and quantum physics, this path has ensured a deep scientific understanding of natural phenomena. Today, physics not only explores fundamental laws but also provides the scientific foundations for technology, space exploration, energy production, communication systems, information technologies, and artificial intelligence. As science progresses, physics will continue to reveal many yet unknown mysteries of the universe.

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