

The Solar System: An Overview

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The Solar System is a gravitationally bound system comprising the Sun and the objects that orbit it, including eight planets, their moons, and various smaller bodies such as dwarf planets, asteroids, and comets.

1 Structure

The Solar System consists of the Sun at its center, with planets orbiting in nearly circular paths. These planets are divided into two categories: the inner, terrestrial planets (Mercury, Venus, Earth, and Mars) and the outer, gas giants (Jupiter and Saturn) and ice giants (Uranus and Neptune).

The terrestrial planets are characterized by their rocky surfaces, relatively small sizes, and proximity to the Sun. In contrast, the gas giants are much larger, primarily composed of hydrogen and helium, and possess numerous moons.

2 Formation

The Solar System formed approximately 4.6 billion years ago from the gravitational collapse of a giant molecular cloud. Most of the mass collected in the center, forming the Sun, while the remaining material flattened into a protoplanetary disk, from which planets, moons, and other solar system objects formed.

This process of formation explains many characteristics we observe today, including the nearly circular, coplanar orbits of the planets and their direction of rotation.

3 Planetary Data

Planet	Diameter (km)	Mass (kg)	Distance from Sun (AU)	Moons
Mercury	4,880	3.3×10^{23}	0.39	0
Venus	12,104	4.87×10^{24}	0.72	0
Earth	12,756	5.97×10^{24}	1.00	1
Mars	6,792	6.42×10^{23}	1.52	2
Jupiter	142,984	1.90×10^{27}	5.20	79
Saturn	120,536	5.68×10^{26}	9.54	82
Uranus	51,118	8.68×10^{25}	19.19	27
Neptune	49,528	1.02×10^{26}	30.07	14

Table 1: Basic properties of the eight planets in our Solar System

4 Exploration

Human exploration of the Solar System began with the first artificial satellite, Sputnik 1, launched by the Soviet Union in 1957. Since then, numerous missions have explored every planet, as well as many moons, asteroids, and comets.

The most distant human-made objects are the Voyager probes, launched in 1977, which have now entered interstellar space beyond the Solar System's boundary.

5 Future Research

Current areas of solar system research include the search for a theoretical ninth planet, studies of potentially habitable environments on moons like Europa and Enceladus, and continued mapping of asteroids that may pose impact threats to Earth.

Future missions aim to return samples from Mars, explore the ice giants which have received relatively little attention, and continue our quest to understand our cosmic neighborhood.