

All of the planets in our solar system lie in nearly the same plane. All of them also orbit the sun in the same direction. These two features provide important clues about how the solar system formed.

The most widely accepted explanation for the formation of the solar system is called the nebular hypothesis. According to this hypothesis, the sun and planets of our solar system formed about 4.6 billion years ago from the collapse of a giant cloud of gas and dust called a nebula. The nebula collapsed because it was drawn together by gravity. Gravity increased at the center of the collapsing nebula, and the cloud started to spin. As the nebula collapsed further, the spinning got faster. Much of the cloud's mass migrated to its center, but the rest of the material flattened out in an enormous disk. As gravity pulled matter toward the center of the disk, the density and pressure at the center became intense. When the pressure at the center was high enough, nuclear fusion began. At this point, the sun came into existence. The outward force of nuclear energy from the sun countered the inward pull of gravity, and this stopped the disk from collapsing further.

Meanwhile, the outer parts of the disk were starting to cool. Matter condensed from the cloud, and small pieces of dust started clumping together. These clumps collided and combined with other clumps. Larger clumps, called planetesimals, attracted smaller clumps with their gravity. Eventually, the planetesimals formed protoplanets, which grew to become the planets and moons that exist in the solar system today. Gravity at the center of the disk attracted heavier particles, such as rock and metal, while lighter particles remained farther out toward the edge of the disk. Because of this gravitational sorting of material, the inner planets—Mercury, Venus, Earth, and Mars—formed from dense rock and metal, whereas the outer planets—Jupiter, Saturn, Uranus and Neptune—formed from lighter materials such as hydrogen, helium, water, ammonia, and methane.

*Questions*

1. List two features of the solar system that provide clues about its formation.
2. In the nebular hypothesis, why did the nebula start to collapse?
3. Describe how the sun formed, according to the nebular hypothesis.
4. How does the nebular hypothesis account for the formation of planets?
5. Based on the nebular hypothesis, why are the inner planets denser than the outer planets?