



## Comet Formation and Dust Tail Suppression Mechanism

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### DESCRIPTION

Comets are large dust and ice objects that orbit the Sun. These ancient objects best known for their long, streaming tails are leftovers from the solar system's formation 4.6 billion years ago. When a comet approaches the Sun, it heats up and spews dust and gases into a massive glowing head larger than most planets. The dust and gases combine to form a tail that stretches for millions of miles away from the Sun. There are most likely billions of comets in the Kuiper Belt and even farther in the Oort cloud orbiting our Sun. The nucleus, coma, ion tail and dust tail are the four visible parts of a comet. Comets have several distinct parts when they are close to the Sun and active.

The nucleus is relatively solid and stable, consisting mostly of ice and gas with a trace of dust and other solids coma a dense cloud of water, carbon dioxide and other neutral gases that has risen from the nucleus. The hydrogen cloud is a massive (millions of kilometers in diameter) but sparse envelope of neutral hydrogen. The dust tail is up to 10 million kilometers long and is composed of smoke-sized dust particles ejected from the nucleus by escaping gases; it is the most visible part of a comet to the naked eye. An ion tail is a plasma tail that can be hundreds of millions of kilometers long and is laced with rays and streamers caused by interactions with the solar wind.

Infrared light is critical for determining the size of a comet. We see the light that a comet reflects from the Sun when we observe

it in visible light. As a result, a large dark comet may appear the same size as a small highly reflective comet. Because of their elliptical orbits comets can sometimes approach the Sun. This means that instead of a circle they orbit the Sun in a large stretched-out oval shape. Aphelion is the point in an orbit that is farthest from the Sun. Most comets aphelion is far beyond the planet Neptune. When the nucleus is far from the Sun it becomes extremely cold and its material becomes solid within the nucleus. Comets are sometimes referred to as "dirty icebergs" or "dirty snowballs" in this state because they contain more than half their mass in ice.

Comets differ from other bodies in the solar system in that their orbits are far more eccentric and inclined to the ecliptic than those of the planets and most asteroids. There are millions of comets in orbit around the Sun. Most take less than two hundred years to complete an orbit, while others travel much slower potentially taking millions of years. As the comet absorbs ultraviolet light chemical processes produce hydrogen which escapes the gravitational pull of the comet and forms a hydrogen envelope. This envelope cannot be seen from Earth because our atmosphere absorbs its light but it has been detected by spacecraft. When a comet passes close to the Sun it loses some of its volatiles. It will eventually become just another rocky mass in our solar system. As a result, on a cosmological time scale comets are said to be short-lived.

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