

"Inner Oort cloud" -- or "Kuiper belt"

The Oort cloud is an immense spherical cloud surrounding the planetary system and extending approximately 3 light years, about 30 trillion kilometers from the Sun. This vast distance is considered the edge of the Sun's orb of physical, gravitational, or dynamical influence.

Within the cloud, comets are typically tens of millions of kilometers apart. They are weakly bound to the sun, and passing stars and other forces can readily change their orbits, sending them into the inner solar system or out to interstellar space. This is especially true of comets on the outer edges of the Oort cloud. The structure of the cloud is believed to consist of a relatively dense core that lies near the ecliptic plane and gradually replenishes the outer boundaries, creating a steady state. One sixth of an estimated six trillion icy objects or comets are in the outer region with the remainder in the relatively dense core.

In addition to stellar perturbations where another star's Oort cloud passes through or close to the Sun's Oort cloud, are the influences of giant molecular clouds and tidal forces. A giant molecular-cloud is by far more massive than the Sun. It is an accumulation of cold hydrogen that is the birthplace of stars and solar systems. These are infrequently encountered, about every 300-500 million years, but when they are encountered, they can violently redistribute comets within the Oort cloud.

Tidal forces affecting the Oort cloud come from stars in the Milky Way's galactic disk with some pull from the galactic core. The tide results from the sun and comets being different distances from these massive amounts of matter. The force on the comets from these tides is greater than the perturbations of passing stars, and comets beyond 200,000 AU are easily lost to interstellar space. This pull contributes to the steady state which replenishes the outer comets that are randomly distributed away from the ecliptic plane.

The total mass of comets in the Oort cloud is estimated to be 40 times that of Earth. This matter is believed to have originated at different distances and therefore temperatures from the sun, which explains the compositional diversity observed in comets.

Typical noontime temperatures are four degrees Celsius above absolute zero. As temperatures move toward absolute zero, the kinetic energy of the molecules approach a finite value. Absolute zero should not be considered a state of zero energy without motion. There still remains some molecular energy, although it is at a minimum, at absolute zero.

The Oort cloud is the source of long-period comets and possibly higher-inclination intermediate comets that were pulled into shorter period orbits by the planets, such as Halley and Swift-Tuttle. Comets can also shift their orbits due to jets of gas and dust that rocket from their icy surface as they approach the sun. Although they get off course, comets do have initial orbits with widely different ranges, from 200 years to once every million years or more. Comets entering the planetary region for the first time, come from an average distance of 44,000 astronomical units.

Long period comets can appear at any time and come from any direction. Bright comets can usually be seen every 5-10 years. Two recent Oort cloud comets were Hyakutake and Hale-Bopp. Hyakutake was average in size, but came to 0.10 AU (15,000,000 km) from Earth, which made it appear especially spectacular. Hale-Bopp, on the other hand, was an unusually large and dynamic comet, ten times that of Halley at comparable distances from the sun, making it appear quite bright, even though it did not approach closer than 1.32 AU (197,000,000 km) to the Earth.

Recognition of the Oort cloud gave explanation to the age old questions: "What are comets, and where do they come from?" In 1950, Jan H. Oort inferred the existence of the Oort cloud from the physical evidence of long-period comets entering the planetary system. This Dutch astronomer, who determined the rotation of the Milky Way galaxy in the 1920's, interpreted comet orbital distribution with only 19 well-measured orbits to study and successfully recognized where these comets came from. Additional gathered data has since confirmed his studies, establishing and expanding our knowledge of the Oort cloud.

