



A Comet's Place In The Solar System



Created for Deep Impact, A NASA Discovery Mission

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Our solar system has four rocky inner planets and four giant gas outer planets. In addition, there are other "small bodies" in the solar system. Comets make up a portion of those small bodies and contain a large percentage of ice since they come from a very cold area. Scientists aren't sure whether comets are more like snowy dirtballs or dirty snowballs depending on the amount of rocky debris mixed with the icy material. Comets seem to be found in two places: some far beyond the edge of the solar system called the Oort Cloud, and some beyond Neptune in a region called the Kuiper Belt. The Oort Cloud may contain a trillion icy comets. The Kuiper Belt comets replenish the population of short period comets (comets that orbit the Sun every 20 years or less).

Comets may be an important part of the recipe for making planets and may be material left over from solar system formation. Some comets may have crashed into forming planets adding to their water and rock, while other comets escaped to establish their own orbits around the sun. Some believe that cometary material may have brought water to Earth through impacts.

The orbits of planets (called ecliptic) line up primarily on one plane like rings on a target. Comet orbits can be different from that of planets. They may arrive in the inner solar system from "above" or "below" the plane of the planets and they travel very far from the Sun. Sometimes, there is a stirring in the Oort Cloud, possibly from the gravity of nearby stars or dark matter bodies that pass through the cloud. That stirring can cause a comet to head from the Oort Cloud into the inner solar system.

The earliest observers who noticed comets in the sky could only learn from looking up just like a person looks at a picture of a comet in a book. Later, observers began to notice that comets moved from night to night in the sky based on their position against the stars. Using what they knew about math, they were able to begin tracking comet orbits. As technologies were developed, scientists could begin observing in a new way to discover the makeup of these icy bodies. Comets may have within them the last pristine clues to the beginning of solar system formation. Scientists want to find evidence of some of those early compounds deep within a comet's interior. Scientists believe the solar system may have formed in this way. As gas and dust swirled around the condensed Sun, molecules came together forming compounds. Water and carbon dioxide are two examples of volatiles/ices while olivine and CH-O-N molecules are dust or refractory compounds. Gravity brings the molecules together in clumps that eventually grow to larger and larger cometesimals. Rather than a solid ice cube, comets may be made of many smaller ice crystals with other organic molecules mixed in. To see what the Deep

Impact science team learned about the composition of comet Tempel 1, see [science results](#).

A modeling exercise like making ice cream filled with different foods to represent "debris" can be a good example of the formation of a dirty snowball "comet". See the [Make a Comet and Eat It](#) activity.