

# THE ORIGIN OF COMETS

*Astronomers find evidence*

*that comets may have been formed in about the same region of the solar system as the earth*

Two astronomers — Jesse L. Greenstein, professor of astrophysics at Caltech, and Antoni Stawikowski, visiting research fellow from the Nicolas Copernicus University of Poland — have found evidence that comets may have originally been created in the vicinity of the earth. The evidence is a rare form of carbon, found in the spectrograph of the comet Ikeya, which suggests a definite link between the solar system and the many comets out in space. The ratio of this carbon (carbon-13) to that of the common form of carbon (carbon-12) is essentially the same in the comet as it is on the earth in such creatures as humans. The ratio is one atom of carbon-13 to every 70 of carbon-12, which is similar to the terrestrial ratio of one to 90.

The new find lends credence to the theory that comets were formed in about the same region of the solar system as the earth, and were blown into their present, vast elliptical orbits by the solar wind as the sun brightened to its present brilliance.

Using the 200-inch Palomar telescope, the two astronomers studied the comet Ikeya last year, when it was so bright that it could be seen with the naked eye. This fact, plus two nights of exceptionally good seeing on Palomar with the great light-gathering power of the world's largest telescope, gave enough illumination from the comet to reveal details never seen before in a comet's spectral pattern. The research is sponsored by the Air Force Office of Scientific Research.

The amounts and kinds of chemicals found in the sun, on the earth, and now in comets, suggests that the solar system was formed from a whirling cloud

of hydrogen and other gases that later condensed into the members of the solar system. Magnetic fields wrapped in the swirls of gas could have served as natural atom-smashers, accelerating hydrogen atoms to high enough velocities to interact with other nuclear particles.

These processes could have produced certain elements that are rare in stars, plus the rare form of carbon, thus indicating that nuclear fires in stars may not be the only manufacturer of elements heavier than hydrogen.

Comets are composed of great blocks of frozen gases, such as carbon dioxide and ice, which could have been the first solid material in the solar system. Each comet is composed of a collection of these celestial icebergs, and astronomers believe that they have been able to survive for a comparatively long time because they are out in the refrigerator of space, far beyond the outermost planets and beyond the eroding effects of the solar wind.

During the brief periods that they approach the sun, the ice blocks heat up a little and evaporate some of the frozen gases. These evaporations form the spectacular long tails, which point away from the sun because the solar wind blows them that way. The tails are not fiery, as the ancients thought them to be, but are made of vapor, which is made to fluoresce by the sun.

The findings on Ikeya not only tend to link comets closer to the earth and to our neighboring planets; they may, in the future, shed light on the birth of the solar system, and particularly the nuclear events that occurred in the early days of the system.