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News

The Sun as comet snatcher

Most of the Solar System's comets may have been stolen from other stars.

Lucas Laursen

New simulations suggest that the Sun may have captured more than its fair share of comets from the primordial star-forming soup. The study, led by Harold Levison of the Southwest Research Institute in Boulder, Colorado, seeks to account for the abundance of comets in the outer reaches of the Solar System.

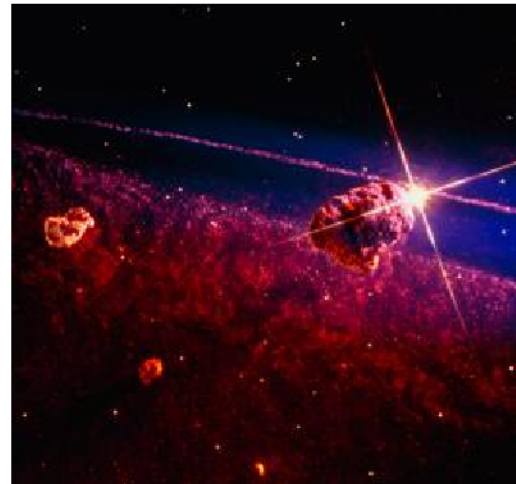
Our Solar System's comets spend most of their time between roughly 5,000 and 100,000 times further away from the Sun than the Earth, in a little-understood region beyond the planets known as the Oort cloud. Occasionally, some zip past the inner Solar System, and a rare few, such as Halley's Comet, return on a regular basis. But the origin of even the most well known comets is something of a mystery.

An influential model of how the Solar System formed predicts that around 6 billion comets in the Oort cloud are home-grown¹. But some astronomers estimate that there are as many as 400 billion comets surrounding the Solar System — a discrepancy that researchers have struggled to explain.

Now the Levison study suggests that these mystery comets may actually have formed around other stars during the first moments of star formation. "Our Sun is a relatively heavy star," explains Ramon Brassler, a co-author of the study, which appears online in *Science* today². When material such as gas, dust and ice began to find gravitational dancing partners, our Sun may have been massive enough to skim spare comets from its more lightweight neighbours.

Stolen goods

Levison and colleagues are not the first to suggest that some comets may be from beyond the Solar System. A team examined the possibility in a 1990 study, but concluded that the Sun's pull was not sufficient to attract enough comets³. "They did not have the computing power to do the simulation we have done," Brassler says.



Comets in the Sun's Oort cloud may be stolen goods.

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Brasser and his colleagues built a computer model in which many stars form near one another in a stellar cluster. In the simulation, each star spawns planetary objects including comets, some of which settle into orbits occupying an extended scattered disk around the star and others of which are ejected into the wider gas cloud enveloping the cluster. About 3 million years into the simulation, the gas surrounding the newly formed stars collapses into each solar system, and most of the free-floating comets find homes around one of the stars. During subsequent flybys with other stars, the simulation shows the Sun snags enough comets to account for its present collection.

However, running such a detailed simulation required the astronomers to make many assumptions about solar system formation, which introduce large uncertainties into the picture. "The most vulnerable assumption is that extended scattered disks would actually exist at the early time considered," says Hans Rickman of Uppsala Astronomical Observatory in Sweden. Extended scattered disks, a hypothetical home for comets in orbit around stars, have not been directly observed, nor do theorists agree on how they form, Rickman says. In one recent model, the disk does not form until 1 billion years after the beginning of a solar system.

Brasser says the simulation also had to assume that all stars have the same number of comets because solid numbers are not available. "People will have difficulty with this assumption," he admits. And for lack of more information, the authors write in the paper that they assumed that other solar systems have a distribution of large planets (whose mass influence cometary orbits) similar to our own.

Even the more widely accepted estimates of the number of comets in the Oort cloud could be too high, Rickman says, and a later formation of the cloud could make it easier to fill with home-grown comets. All the uncertainty, he says, "makes me think there does not have to be any problem at all".

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