

Comet reservoir gets more real

Comets may make a spectacle of themselves when they near the sun, but it's tricky to determine exactly where any of them was born. Simulations tracing the orbits of comets back in time suggest that the solar system harbors two reservoirs of these icy bodies. A disk-shaped storehouse, known as the Kuiper belt, lies just beyond the orbits of Pluto and Neptune. A vast spherical region called the Oort cloud originated even closer to the sun, between the orbits of Uranus and Neptune, but was kicked out about 1,000 times farther than the belt.

Over the past 5 years, as astronomers have imaged more than 30 residents of the Kuiper belt, this proposed storehouse has become accepted as a source of comets. Astronomers have little hope of detecting the present-day members of the more remote Oort cloud, however. Now, ultraviolet studies of Comet Hale-Bopp provide support for the existence of the cloud.

Using the Extreme Ultraviolet Explorer satellite, Michael J. Mumma and Vladimir A. Krasnopolsky of NASA's Goddard Space Flight Center in Greenbelt, Md., and their colleagues recently searched for emissions from neon in the spectra of Hale-Bopp. They discovered that the abundance of neon relative to oxygen in the comet, thought to be an émigré from the Oort cloud, is at most one-twenty-fifth the abundance in the sun and could well be zero. The team had previously found that another Oort cloud comet, Hyakutake, also contains little or no neon.

Neon ice turns to vapor at 25 kelvins, readily escaping the nucleus of a comet. The absence of neon suggests that the grains of interstellar ice that built Hale-Bopp and Hyakutake must have done so in a part of the solar system where temperatures are above 25 kelvins. The region between Uranus and Neptune meets this temperature criterion without being hot enough to boil off other ices found in the comet.

The match in temperature adds to the evidence that the Oort cloud did indeed assemble between these two planets and only later migrated to the fringes of the solar system. The team reported the neon measurement in an April 14 circular of the International Astronomical Union. —R.C.

X rays and comets

Last spring, when astronomers detected an X-ray glow surrounding Comet Hyakutake, theorists scurried to explain the unexpected finding (SN: 6/1/96, p. 346). The ROSAT and Extreme Ultraviolet Explorer satellites have since revealed that Hyakutake is not alone—at least 10 comets, including Hale-Bopp, are now known to exhibit an X-ray glow as they near the sun. Scientists are struggling to account for the behavior.

One theory, proposed by Thomas E. Cravens of the University of Kansas in Lawrence, invokes the solar wind, the stream of charged particles blowing from the sun. He suggests that something special happens when the most highly ionized of those particles, such as oxygen stripped of six of its eight electrons, meets neutral atoms that have boiled off a comet nucleus. The ion steals an electron from the neutral atom, and as the captured electron spirals toward the ion, it emits X rays.

Neutral atoms wander far from a comet's core. Cravens contends that his model can thus account for the X-ray glow detected up to 100,000 kilometers from a comet's nucleus. Some researchers argue, however, that this process, known as charge transfer, would produce a steady stream of X rays rather than the variable emissions observed from Hyakutake.

In a scenario proposed independently by Theodore G. Northrop of NASA's Goddard Space Flight Center in Greenbelt, Md., and by D.A. Mendis of the University of California, San Diego and his collaborators, high-speed electrons in the interplanetary magnetic field collide with atoms from the comet, causing the electrons to decelerate and emit X rays. Spectra of the X-ray emissions may distinguish between the models.—R.C.

Squares live longer

For people who want to stay healthy and live well into their seventies, there is something far more important than high-fiber diets and low-impact workouts. Longevity, at least for men, seems to depend on a penchant for emotional stability that wards off extreme pangs of depression, even if it renders life a little boring. Perhaps most telling for aging bodies, alcohol and cigarettes prove far more alluring to those who at times experience mental anguish than to individuals whose middle-of-the-road mood never swerves.

"A personality tendency to preserve a consistent mood that is largely free of psychological distress promotes physical health much more than exercise or eating habits [do]," says George E. Vaillant of Brigham and Women's Hospital in Boston.

Vaillant's contention rests on an ongoing study of men first recruited when they were Harvard University undergraduates in 1942. At age 52, a set of the Harvard men who were in good health was divided into three groups.

The 63 undistressed men, or "squares," had never ingested mood-altering drugs, consulted a psychiatrist, or abused alcohol. The 74 "distressed" men had abused alcohol and either regularly used tranquilizers or consulted a psychiatrist. This group included 28 of the 29 men who had suffered from at least one bout of major depression. The third group contained 99 men, including one who had experienced major depression, who were classified as "intermediate" between the other two groups.

At age 70, the squares were much healthier physically than either the distressed or the intermediate men on a variety of measures, including heart and lung function. At 75, the age by which 40 percent of all men born in the United States have died, differences among the Harvard groups were striking. Only 5 percent of the squares had died, compared to 25 percent of the intermediate group, and 38 percent of the distressed men. These findings held regardless of physical health before age 55, diet, or consumption of alcohol or cigarettes.

Attempts to fend off the ravages of major depression often included cigarette smoking and alcohol abuse, which probably boosted the death rate of distressed men, Vaillant reports.

Squares, on the other hand, displayed an abiding contentment with their lives that appeared to squelch mood-altering aspirations. For instance, squares tended to stay married to the same partner and to continue working after age 65.

"The findings support the hypothesis that depression occurs along a continuum, and men at the opposite pole from those afflicted with major depression have unusually good physical health late in life," Vaillant says. —B.B.

Mental disorders in Israel

A national survey of native-born Israeli young adults finds that nearly half of them have suffered at some time from a mental disorder, a proportion comparable to that for people living in the United States. However, only about 3 percent of Israelis encounter three or more different psychiatric conditions during the course of their lives, a particularly debilitating situation that showed up nearly five times as often in a comparable U.S. survey (SN: 1/22/94, p. 55).

The new survey, directed by Andrew E. Skodol II of the New York State Psychiatric Institute in New York City, consists of 5,200 Israeli men and women selected at random from a government population registry. Volunteers, who ranged in age from 24 to 33, were interviewed by psychiatrists.

About 17 percent of the Israelis met the criteria for a current mental disorder. The rate of lifetime major depression in the women, 29 percent, was twice that of men. Both of these findings are similar to those for U.S. citizens. In contrast, only 6 percent of Israelis had ever abused alcohol or illicit drugs, compared to 25 percent of U.S. adults. —B.B.