

Astronomy

Ron Cowen reports from Bethesda, Md., at the annual meeting of the American Astronomical Society's Division for Planetary Sciences

News from Pluto and beyond

Planetary scientists found a surprise while analyzing Hubble Space Telescope images of Pluto and its moon Charon. The set of 60 images, taken during a 15-month period before the telescope's repair, reveals that Charon moves in a slightly elliptical path around Pluto. That's puzzling, because Pluto's gravitational embrace changes an elliptical orbit rapidly into a perfectly circular one.

David J. Tholen of the University of Hawaii in Honolulu and his collaborators on the Hubble study, Marc W. Buie and Lawrence H. Wasserman of the Lowell Observatory in Flagstaff, Ariz., have an explanation for the unexpected observations. They say the simplest way to account for Charon's slightly oval path is to assume that an object slammed into Pluto or its moon sometime in the past 10 million years.

Such a collision, Tholen says, must have been powerful enough to throw Charon slightly off its orbit and recent enough that gravity wouldn't have restored that circular path yet.

Stanton J. Peale of the University of California, Santa Barbara, calculates that if an object moving at 1 kilometer per second struck Pluto head-on, it would have to measure at least 250 km across to alter Charon's orbit. An object striking Charon might need only half that diameter to do the job.

Tholen says that if a large object had hit Charon or Pluto recently, it would have left a noticeable mark, either gouging out material or depositing fragments of its own on the surface of the planet or the moon. He speculates that some of the darker regions on Pluto may stem from such a collision and that a flyby mission to the planet could find out for sure.

A decade ago, says Jane X. Luu of Harvard University, planetary scientists would have laughed at the idea that an object had collided with Pluto recently. No one had observed even a single body anywhere near the planet, so how could a collision have taken place? But over the past few years, Luu, University of Hawaii astronomers David Jewitt and Jun Chen, and others have found several objects littering the outer solar system, making collisions far more probable (SN: 10/9/93, p.230).

In 1992, when they had detected just one such body, Luu and Jewitt suggested that they were seeing the first known resident of the Kuiper belt, a proposed reservoir of short-period comets. They now report that their team, along with observers in Europe, has found 17 distant bodies larger than 100 km — all of them presumed residents of the inner part of the Kuiper belt.

Noting that these objects were found in surveys of only a few patches of sky, Jewitt estimates that the belt must contain at least 35,000 residents larger than 100 km in diameter. Such a population would be several hundred times the estimated number of main-belt asteroids in that size range.

Jewitt says that 8 of the 17 objects have orbits that may overlap with Neptune's, which could render them unstable. However, at least three and perhaps all eight have a special orbital relationship with Neptune. Each time one of these objects makes three passes around the sun, Neptune goes around twice; this ensures that the bodies stay far enough from the planet for their orbits to remain stable. Pluto has the same relationship with Neptune, prompting Jewitt to dub the bodies "Plutinos" and lending support to the notion that Pluto itself originated in the Kuiper belt.

He notes that another class of solar system bodies, known as Centaurs, may be the missing link between residents of the Kuiper belt and comets that have journeyed to the inner solar system. This class, which includes the giant comet Chiron, has unstable, planet-crossing orbits and lies beyond Jupiter. Jewitt suggests that the Centaurs escaped from the Kuiper belt and in a million years will either be ejected from the solar system or make their way sunward to become short-period comets.

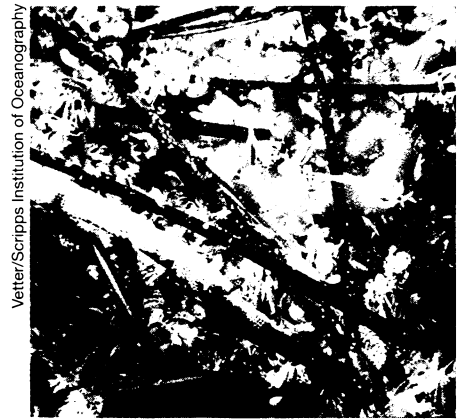
Biology

Daunting densities in undersea scum

Each Dec. 31, people cram into New York City's Times Square to hail the coming of the new year. But this crowd pales in comparison to the one that lives in decaying surf grass off Southern California. Tides, currents, and wind wash grass and kelp into the underwater canyon there, where these plants form a green-brown mat, says Eric W. Vetter of the Scripps Institution of Oceanography.

While scuba diving, Vetter discovered teeming populations of leptostracans — small, shrimp-like invertebrates — and amphipods in this detritus. His spring sampling indicates that some 690,000 leptostracans and 780,000 amphipods, of a total of 3 million crustaceans, crowd into each square meter. That degree of crowding far exceeds any known density of macroscopic animals, he notes.

The gut contents of fish hovering near these mats indicate that the tiny creatures, whose biomass exceeds 1 kilogram per square meter, are an important food supply, Vetter reports in the Nov. 3 NATURE. He suspects many coastal fish rely on similar nutritionally rich hot spots and hopes his find will prompt other researchers to investigate decaying grass mats.



Crustacean-filled detritus.

Hummingbirds take over bees' work

Their wings a blur, hummingbirds flit among Western and Southwestern U.S. meadows, oblivious to their effect on other pollinators. Yet over the millennia, they have moved in on bees and butterflies, says Verne Grant, a botanist at the University of Texas at Austin.

Most of the 129 types of U.S. flowers that now depend on the hummingbirds' visits belong to the Arcto-Tertiary plant group, which did not expand south into hummingbird habitat until 58 million years ago. Indian paintbrushes, part of the genus *Castilleja*, were early arrivals, he notes.

Now, 48 of that genus' 200 species have made the switch from other pollinators to birds, says Grant. These 48 have spread across 24 of 29 plant communities in this region. "*Castilleja* got in on the ground floor and was a big success," he adds.

Other species followed. He knows of 15 members of the genus *Penstemon* that rely on hummingbirds and may have evolved this reliance independently of one another. Seven kinds of columbines also have abandoned bees for birds, but most of the other 16 genera with hummingbird pollinators are very recent converts, with just one or two species in each making use of these birds, he adds.

Grant thinks the Arcto-Tertiary plants grew alongside flowers already being pollinated by hummingbirds. Because these birds tend to seek out new food sources, they probably visited any newcomer — especially if their normal food sources were in short supply — and perhaps proved a reliable pollination partner for that plant. As a result, the plant evolved flowers more conducive to birds than to bees or butterflies, he suggests in the Oct. 25 PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.



Hummingbird visits a *delphinium*.