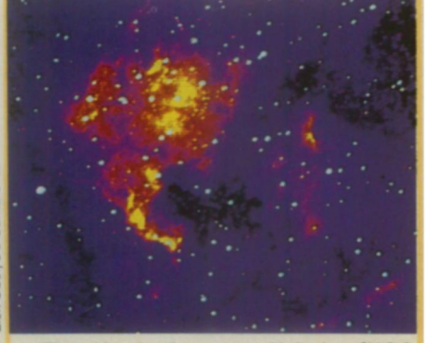
of changing completely the emphasis of blood-grouping [biochemical identifications] in forensic science," say Gill, Jeffreys and Werrett. Currently, a series of tests can rule out suspects, but it cannot produce a positive identification. With the DNA test, using two types of minisatellite DNA, the chance of a mistaken identification is less than 5×10^{-19}.

Although the potential is great, DNA fingerprints are not expected to replace immediately the current battery of tests. The new methods still must be subjected to extensive family and population testing. Barbara E. Dodd of London Hospital Medical College says that the DNA fingerprint test, as Jeffreys currently performs it, is very time-consuming and needs meticulous expertise.

In at least one case already DNA fingerprinting has been used to settle a dispute. Jeffreys helped a Ghanian woman living in the U.K. to convince immigration officials that a boy returning to the U.K. was her son and not the son of one of her sisters. The problem was especially difficult because the boy's father and the woman's sisters were not available to test. Jeffreys calculated that the chance that the woman is the boy's aunt, rather than his mother, is less than 1 in 100,000. Jeffreys and his colleagues conclude, "This difficult case demonstrates how DNA fingerprints can give unequivocal positive evidence of relationship, even in some cases where critical family members are missing." *— J.A. Miller*

A wide-angle CCD camera



Lick Obs./UC Santa Cruz

The North America Nebula (NGC 7000) is a region of ionized hydrogen in the constellation Cygnus. A lane of dark dust superimposed on the glowing hydrogen gives the appearance of the U.S. East Coast and the Gulf of Mexico. This is one of the first pictures made with a new camera designed for studies of Halley's comet by George Herbig and Burt Jones of the Lick Observatory in Santa Cruz, Calif. The camera combines the high light sensitivity of charge-coupled-device (CCD) photosensors with a wide field of view (4° by 6.5°) that CCD cameras have heretofore lacked. The picture was taken by Rick Pogge.

Atmospheric footprints of icy meteors

On the basis of radar measurements, scientists have come to think of the meteors that rain on the earth as small, pebble-like objects plunging through the atmosphere. But recent satellite images of the sunlit side of the atmosphere imply another picture, in which a meteor starts as a much more massive clump of material, possibly a dirty-snowball-type piece of a comet, which sheds gases in the upper atmosphere before releasing the pebbles that are tracked by radar.

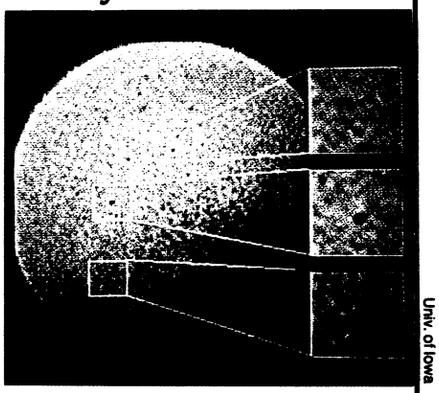
This means "there has to be 1,000 to 10,000 times more material coming in and being added to the earth's atmosphere than we would have guessed with radar measurements," says Louis Frank.

Frank, John Sigwarth and John Craven, all at the University of Iowa in Iowa City, base their conclusion on a study of images of the earth's dayglow — sunlight absorbed and then reradiated by oxygen atoms residing at altitudes of about 200 to 300 kilometers. These images were taken by an ultraviolet sensor aboard NASA's Dynamic Explorer (DE-1) Satellite, launched in August 1981. In the images, the researchers discovered dark spots, or holes, which they attribute to the meteors piercing the atmosphere.

"This is an entirely new and unexpected phenomenon," says Sigwarth, who presented the group's findings Dec. 12 at the meeting of the American Geophysical Union in San Francisco.

At first, the researchers thought the dark spots were errors, but when the holes appeared in consecutive images, Frank's group was convinced they were seeing a real event. According to Sigwarth, each hole expands like a drop of dye spreading out in a glass of water; within about 30 seconds the dayglow intensity drops by about 95 percent over an area of about 3,000 square kilometers. Then, over the next 3.5 minutes, the dayglow intensity increases toward its normal value as the hole grows to an area of about 25,000 km^2.

The researchers think the holes are related to the passage of meteors because the change in the number of holes created with time parallels the observed distribution of meteors. For example, in analyzing 10,000 images, they found that more holes are produced over the dawn side of the earth than over the dusk side. The dawn side faces the forward direction of the earth's orbit, so it should sweep up more meteors, "just as a windshield wiper collects more drops in front of it than it does behind," says Sigwarth. The researchers also noted that the number of holes doubled on Jan. 3, 1982 — just the time when the Quadrantid, an annual high-latitude meteor shower, passed through the atmosphere.



Univ. of Iowa

Satellite image of dayglow, primarily the emission of light from atomic oxygen at wavelengths of 130.4 nanometers. The dark spots in the dayglow, enlarged to the right, are thought to be caused by the passage of meteors through the upper atmosphere.

The big remaining question is how the meteors create the holes. "It could be that the meteor is laying a blanket over the atmosphere so that the light can't get in and back out of the atmosphere," says Sigwarth. Another possibility is that the meteor material, such as water vapor, is chemically reacting with the atmospheric oxygen so that there is less free atomic oxygen to produce the dayglow in the ultraviolet. "There are a lot of unknowns in the problem because it's unclear exactly what [substances] are in meteors before they hit the atmosphere," says Sigwarth. Within the year, the group is hoping to collaborate with another group to launch a rocket that would release a canister of water vapor into the upper atmosphere to see if it could simulate the effect of a meteor.

Thus far, from the sizes of the holes created by the vaporized meteor material, the researchers conclude that the mass of each meteor is probably around 10 kilograms — much greater than the pebbles, each weighing less than a gram. And in order to deposit most of that material into the atmosphere, a meteor must be mostly like a fluffy snowball and contain a relatively small amount of the denser pebbles that fall to the earth.

If this interpretation is correct, says Frank, there may be many more of these "baby" comets in space than anyone ever suspected. And this conclusion is possible only because of the DE-1 satellite, which Frank says is the first attempt to view the earth's atmosphere on a global scale. With the DE-1, he says, the earth can be used as a giant meteor detector. *— S. Weisburd*