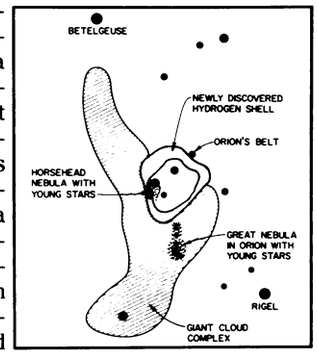
Astronomy

Ivars Peterson reports from Arlington, Va., at a meeting of the American Astronomical Society

Mapping cloudy births in Orion



IBM Research

In the most extensive mapping yet of radio-wave emissions from atomic hydrogen in a star-forming region, astronomers have made two significant discoveries: a rapidly expanding shell of warm hydrogen gas that appears to trigger star formation when it collides with a cloud of cooler molecular hydrogen, and a huge, diffuse "atmosphere" of atomic hydrogen surrounding the large molecular cloud. This complicated pattern of clouds and gas, only 1,500 light-years from Earth, lies within the constellation Orion.

To map this region, scientists used the 140-foot telescope at the National Radio Astronomy Observatory in Green Bank, W.Va., to observe the area for several days. A powerful computer converted the millions of readings into a detailed map showing the locations, velocities and densities of more than 20 atomic hydrogen clouds and filaments in the region.

The hydrogen shell, about 200 light-years across and expanding in all directions at 7 kilometers per second, lies near the three bright stars that make up Orion's belt. The forces driving the shell's motion have apparently carved a cavity out of an adjacent, dense molecular cloud and triggered a burst of star formation where the shell and cloud meet.

The discovery of an atomic hydrogen atmosphere surrounding the Orion molecular cloud provides important information about the early stages of star formation and the details of molecular cloud evolution, the researchers say. That atmosphere acts like a cocoon, shielding the more fragile hydrogen molecules in the molecular cloud from the disruptive effects of starlight and compressing the molecular gas in preparation for star formation.

The mapping was conducted by Debra M. Elmegreen of Vassar College in Poughkeepsie, N.Y., Bruce G. Elmegreen of the IBM Thomas J. Watson Research Center in Yorktown Heights, N.Y., and Frederick R. Chromey of Vassar and IBM.

Speeding to an open universe

Careful measurements of the velocity of a group of galaxies seem to indicate that the universe contains insufficient mass to overcome the force of the giant explosion that started its expansion. These data suggest that the universe will never stop expanding, says Gregory D. Bothun of the University of Michigan at Ann Arbor.

Bothun, working with Margaret J. Geller and John P. Huchra of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Mass., determined the velocity of a group of galaxies located on the "surface" of a huge bubble embedded in the so-called Great Wall – a recently identified band of galaxies 500 million light-years long, 200 million light-years wide and 15 million light-years thick (SN: 11/25/89, p.340). This bubble, whose interior contains very few galaxies, sits next to a significant concentration of galaxies called the Coma cluster.

Bothun's measurements show that the gravitational force exerted by the Coma cluster attracts the galaxies on the bubble surface, pulling them off course from the direction of the universe's expansion. The strength of that attraction depends on how much the rest of the mass in the universe pulls the bubble galaxies away from the cluster. By calculating the Coma contribution, Bothun and his colleagues deduce that the "mean mass density" of the universe is less than one-third that required to reverse its outward expansion.

Biology

Scientists create sickle-celled mouse

Sickle cell anemia has long been a thorn in the geneticist's side. The inherited disease was among the first to have its underlying molecular basis revealed, yet after 30 years of intensive efforts, researchers have failed to provide a therapeutic breakthrough for those who suffer its complications (SN: 12/2/89, p.360).

A laboratory animal with sickle cell disease could offer new insights into the mechanisms of red-blood-cell sickling and serve as an ideal subject for experimental drugs. Indeed, scientists lay much of the blame for the slow research progress on the lack of such an animal model.

Last week, in a major step toward rectifying that situation, researchers announced they had created the world's first mice with cells that sickle. David R. Greaves of the National Institute for Medical Research in London, England, and his colleagues accomplished the feat by inserting a human sickle cell gene into embryonic mice.

Unfortunately for the scientists, the mice show no signs of the classic anemia, nor do they show a predisposition to infection or strokes – both common among humans with the disorder. Nonetheless, the animals' red blood cells apparently do deform under low-oxygen conditions. In other ways, too, they resemble red cells in humans with sickle cell trait, a milder form of sickle cell disease.

The researchers suggest in the Jan. 11 NATURE that the animals, imperfect as they are, may prove valuable for screening anti-sickling drugs. They hope to produce sicklier versions either by breeding these mice with others suffering from a related hemoglobin abnormality called thalassemia or by boosting the expression of the inserted sickling gene.

"It may turn out, of course, that the size of the red cells, the circulation dynamics and the regulation of the microcirculation are so different in mice and men" that a mouse model may not prove particularly useful for studying the human disease, writes D.J. Weatherall of the University of Oxford, England, in a commentary accompanying the research report.

Rare mint patch makes ideal picnic spot

Researchers have discovered a powerful, natural insect repellent within the leaves of an endangered mint plant in central Florida. Even a whiff of the substance sends ants and other insects fleeing, they report in the February CHEMOECOLOGY.

Thomas Eisner of Cornell University in Ithaca, N.Y., grew curious about the plant, *Diceranda frutescens,* while walking through a patch of it at the Archbold Biological Station in Lake Placid, Fla. Its intense scent, resembling that of peppermint oil, filled the air after the biologist's walk disturbed the plants. A look at the leaves showed they were "remarkably free of insect-inflicted injury," Eisner says.

His colleagues' chemical analysis of the leaves revealed a new mint oil, which they named trans-pulegol. Moreover, the oil – along with a dozen other mint oils previously identified in other plants – remains sealed in tiny capsules that act as chemical "grenades," exploding when insects chew the leaves. This allows the plant to economize its defense expenditures, releasing the compound only when needed, Eisner says. Trans-pulegol is the major ingredient in the grenades.

Confirming the repellent's potency, the researchers sent ants scurrying from a sugar-water feast by cutting through a nearby *D. frutescens* leaf. They have also identified a caterpillar that eats the mint leaves and regurgitates its stomach contents onto itself in an apparently successful attempt to repel natural enemies, including ants. The researchers are continuing these experiments with a synthetic version of the chemical they have produced in the laboratory.