

*Dietrick E. Thomsen reports from Ames, Iowa, at the meeting of the American Astronomical Society*

## Falling into a black hole

The current standard theory of quasars proposes that these bright, starlike, but extragalactic objects have black holes at their centers. The extremely high flux of radiation coming out of a quasar is generated by the gravitational energy of matter falling into the black hole. Plenty of secondary evidence supports this picture. Now Martin Gaskell of Ohio State University in Columbus presents what seems to be the first direct evidence for gas falling into a black hole.

The evidence comes from studies of the spectra taken by the International Ultraviolet Explorer satellite of the radiation from a gas cloud in the galaxy NGC 4151. Analysis of the details of the shapes of the lines in these spectra show that the predominant motion of the cloud is inward, Gaskell says. He believes he can exclude outflow to a 99.9 percent confidence limit. From knowledge of this inflow he can estimate the mass of the black hole at 60 million times that of the sun. It may be the center of a very weak quasar, he says, and he concludes, "Accretion [of matter] on black holes in quasars is now on an observational footing."

## Making medium-weight elements now

The universe has 92 naturally occurring chemical elements. Astrophysicists and nuclear physicists together have concluded that the universe started out with only hydrogen and its isotope deuterium. Ordinary processes in the more common kinds of stars make the lighter elements, up to about carbon and oxygen. Heavier ones must come from unusual events, such as stellar explosions, or more exotic kinds of stars or stellar objects, but no one is quite sure of the details. In gamma-ray spectra taken by the HEAO 3 satellite Alan S. Jacobson of Caltech's Jet Propulsion Laboratory in Pasadena now finds the first direct evidence that synthesis of medium-weight elements is now going on in interstellar space.

The gamma-ray spectrometer on HEAO 3 found radiation with an energy of 1,808 kilo-electron-volts coming from the direction of the center of our galaxy. This energy is characteristic of radioactive aluminum-26, an isotope with a lifetime of about a million years. The shortness of the lifetime combined with the strength of the radiation indicates that the aluminum is being formed now. Observations with the Solar Maximum Mission satellite have lately confirmed the HEAO 3 finding, Jacobson says.

Probably the most popular theory of the formation of medium-weight elements like aluminum proposes that they are made in shock waves that arise during the explosion of a star into a supernova. However, Jacobson says, the amount of aluminum seen is about three times what would be expected if supernovas were the sole source. Other possible sources, he says, are novas (another kind of stellar explosion), red giant stars, Wolf-Rayet stars or stars of spectral class O. According to Jacobson, novas are most likely.

## Galactic positronium mystery deepens

Observations over the last decade have shown that somewhere toward the center of the galaxy is an object containing a large amount of positronium, which is made up of electrons and their antiparticles positrons bound together. Gradual annihilation of the positronium yields gamma rays with a characteristic energy of 511 kilo-electron-volts. So much antimatter in our part of the universe is very unusual. Now observations with the HEAO 3 satellite and subsequent balloon flights show that the brightness of this object varies over time, reports Alan S. Jacobson of Caltech's Jet Propulsion Laboratory, thus deepening its mystery. However, the variations allow a limit to be set to its size —  $10^{13}$  kilometers. It could be a cloud surrounding a black hole that is a good source of positrons.

## For those who don't read Japanese

Last year, Japan had a \$45.6 billion trade surplus, while the United States had a world-trade deficit of \$150 billion — its biggest ever. One reason widely credited for Japan's ascending position in world trade is its industries' quick assimilation of science and technology advances made — and published — elsewhere. Congress believes the United States should take a lesson from Japan. The Japanese Technical Literature Act, passed by unanimous consent in the House late last month, seeks to foster that by improving access to Japanese science and engineering.

An Information Center of Science and Technology, supported by the Japanese government, processes and abstracts more than 10,000 foreign and domestic journals, as well as technical reports, conference presentations and patents for use by Japan's manufacturing and business community. In supporting the new bill on the House floor, Rep. Manuel Lujan (R-N.M.) cited a 1981 survey which estimated that data in 75 percent of Japan's approximately 10,000 technical journals were unavailable to non-Japanese-reading researchers.

And those data might indeed be valuable, according to a Senate report on the issue last fall. Japan now ranks third in world spending on research, supports the world's third largest research labor force and per capita spends nearly as much on research and development as the United States. "Much of this research is widely recognized as first rate," the Senate report said. Moreover, it added, a recent U.S. Chamber of Commerce study has concluded that U.S. technology is being overtaken by the Japanese in 12 important areas, including advanced ceramics, optical fibers and large-scale integrated circuits.

To remain internationally competitive with Japanese technology, the new bill would have the United States spend \$1 million annually to: monitor Japanese technical activities and developments; consult businesses, professional societies and libraries for their Japanese-information needs; acquire, index, translate and disseminate Japanese technical information; publish a directory of this information; and have the Commerce Department prepare annual reports on important Japanese advances in areas such as computers, semiconductors, biotechnology, robotics and manufacturing.

This bill is a virtual carbon copy of one that cleared the Senate late last year. Because it has bipartisan support — including the support of the Reagan administration — it is thought to have a good chance of becoming law.

## News updates

- On July 9, the Food and Drug Administration issued final rules banning the use of six different types of sulfites in fresh produce. Used to prevent wilting and discoloring, these compounds can initiate life-threatening allergic reactions in asthmatics (SN:8/17/85,p.100). The rules take effect in 30 days.

- Practical ramifications of the new U.S. Supreme Court ruling on the Gramm-Rudman-Hollings law are being tested by a lawsuit filed in U.S. District Court last week. The action, which could have broad implications for any of those whose federal funds were withheld under the law, seeks to test whether the government can keep money it has already impounded under the law. Last week the high court ruled that the role of a key actor in that impoundment — the Comptroller General, head of the General Accounting Office — was unconstitutional (SN:7/12/86,p.22). In its suit, the National Treasury Employees Union asks that more than \$1 billion in congressionally authorized 1986 cost-of-living adjustments be released to the union's more than 1 million retirees.

- On June 20, President Reagan signed the 1986 Safe Drinking Water legislation (SN:5/31/86,p.341), making it the first major environmental bill to become law this year.