periments show that hahnium has a number of chemical properties resembling those of protactinium, a naturally occurring element situated beside uranium in the so-called actinide series. Protactinium is a dangerous, highly toxic material that requires precautions similar to those used when handling plutonium.

"Like plutonium, hahnium seems to have very nasty properties," Hoffman says. "There are many challenges in these studies of the heaviest elements." She described the results of her team's investigations at last week's American Chemical Society meeting in Washington, D.C.

The researchers synthesize hahnium by firing oxygen ions into a target consisting of berkelium-249. The resulting isotope, hahnium-262, has a half-life of 35 seconds, allowing only a tantalizingly brief interval in which to dissolve the isotope in water to study its chemistry in solution, or to react it with bromine to study its properties as a gas.

Like tantalum ions, hahnium ions in nitric acid stick to glass. However, whereas the organic solvent methyl isobutyl ketone readily extracts tantalum from solution, it fails to pull out hahnium. This result, along with hahnium's response to other solvents and the behavior of hahnium bromide in the gas phase, seems to put the element nearer to the protactinium camp than the tantalum group.

The findings support the notion that subtle quantum-mechanical and relativistic effects play an important role in establishing hahnium's electron arrangement, which determines the element's chemical properties. Such special effects are usually negligible in lighter elements.

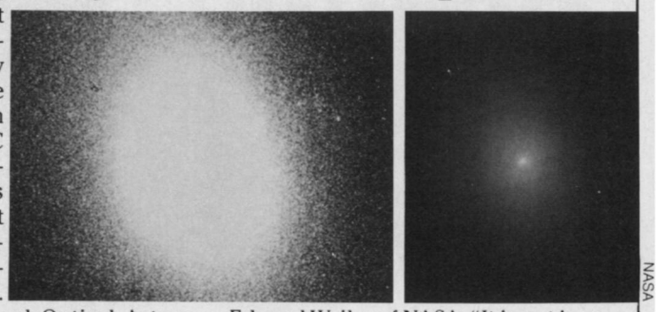
"The nuclear and chemical properties of these [heavy] elements go hand in hand," Hoffman says. "They're hard to separate."

Hoffman would like to extend her chemical investigations to elements with a higher atomic number (a larger number of protons) than hahnium, but the half-lives of known isotopes of elements 106, 107, 108 and 109 — sighted but not yet named — are 0.8 second or less, often much less. That severely limits the time available for studying their chemistry.

However, researchers continue to search for heavy-element isotopes with significantly longer half-lives. The synthesis in 1986 of two relatively long-lived isotopes, lawrencium-261 and lawrencium-262, furnishes grounds for hope. These isotopes have half-lives 100 to 500 times longer than predicted by theory — sufficiently long to permit detailed studies of the chemical properties of lawrencium, the last member of the actinide series.

Lawrencium-262 also decays into nobelium-262, an isotope of element 102 containing more neutrons than any other known atomic nucleus. — *I. Peterson*

Within a galaxy and outside a supernova



NASA

Astronomers got more than they expected when they turned the Hubble Space Telescope on the galaxy NGC 7457, about 40 million light-years away. "We thought it would be a boring, ordinary galaxy," says Tod R. Lauer of the National Optical Astronomy Observatories in Tucson, Ariz.

Instead, Hubble's wide-field and planetary camera found a galactic center packed with about 400 times more stars than predicted from Earth observations. The left image shows NGC 7457's center, while the right image, with contrast adjusted, reveals a huge concentration of stars at the galaxy's heart.

The finding, announced last week, suggests that the centers of many "normal" galaxies may contain far more stars than previously believed. It also raises the question of whether the crowd of stars in NGC 7457 results from the gravitational attraction of a black hole at its center.

"We're not claiming that this is a black hole," says Hubble program scientist Edward Weiler of NASA. "It is not inconsistent with a black hole, however."

Hubble's faint-object camera, provided by the European Space Agency, also photographed a bright ring or shell of gas surrounding supernova 1987A. Both ground-based and satellite observations had indicated the existence of the material, a slowly moving remnant of the hydrogen-rich envelope ejected by the star during its red supergiant stage, some 10,000 years before it exploded.

A few hours after the cataclysmic blast, ultraviolet radiation from the supernova heated the gas and set it aglow. Within a few decades, astronomers say, fast-moving debris from the explosion will completely engulf the gas. — *J. Eberhart*

Energy studies proposed to cool greenhouse

To confront the threat of a greenhouse warming, the federal government should substantially increase its support for research into energy conservation and the use of renewable energy resources such as solar power and wind, a panel of experts concludes in a report issued last week.

The National Research Council panel suggests boosting these efforts by an additional $300 million, which amounts to about 20 percent of the current budget for energy-related research and development. It recommends obtaining such funds from money earmarked for research into magnetic fusion and fossil-fuels development.

The panel also suggests that the government consider a more intensive, multibillion-dollar effort in energy research, which the nation could adopt if concerns about greenhouse-gas emissions grow in the future. These funds would go toward developing emissions-reducing technologies not economically viable at present.

As a first step, though, the panel recommends pursuing energy research that will both reduce emissions and address some unrelated concerns such as national security. Enhancing studies on conservation and renewable energy would not only help cut emissions but also reduce U.S. dependency on foreign fuels, notes panel chairman David L. Morrison of the MITRE Corp. in McLean, Va.

During the 1980s, while oil prices dropped considerably, federal funding for renewable-energy R&D declined by 89 percent, and support for conservation programs dropped by 61 percent. "Current funding for alternative-energy R&D in the United States is not sufficient to address the problem of achieving major reduction in greenhouse-gas emissions," the panel concludes.

While many conservation groups welcome the recommendations, the new report has drawn criticism from some energy analysts. "Advocating more research is not, in my view, the primary way to reduce greenhouse-gas emissions," says James MacKenzie, a senior associate at the World Resources Institute in Washington, D.C. MacKenzie contends that the government must ensure that industry and the public adopt energy-efficient, low-pollution technologies. "There's a lot available now. We're incorporating some of it now, but we could be doing much better."

MacKenzie also warns against spending too much on federal research without stimulating research by private companies. — *R. Monastersky*