science news

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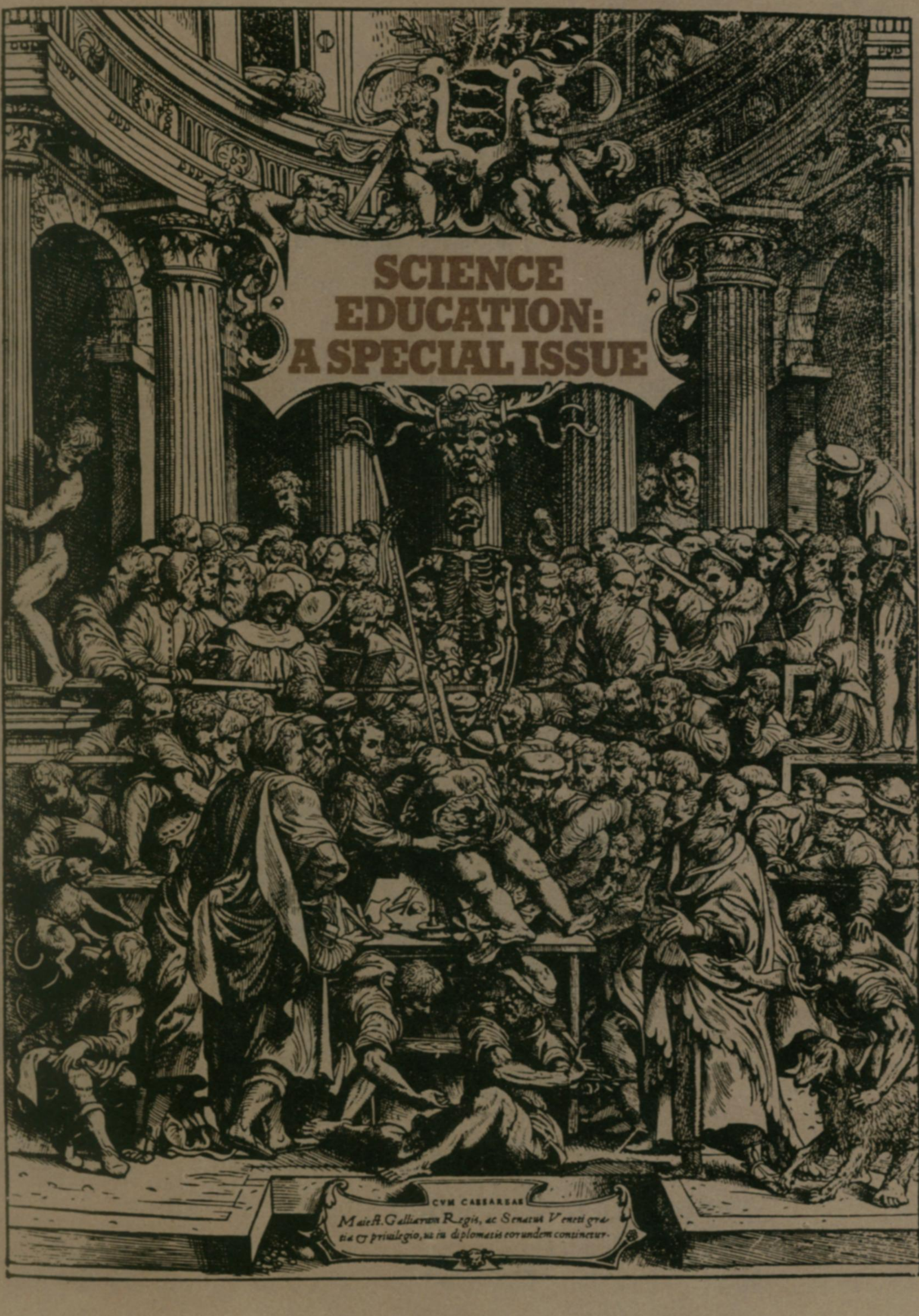


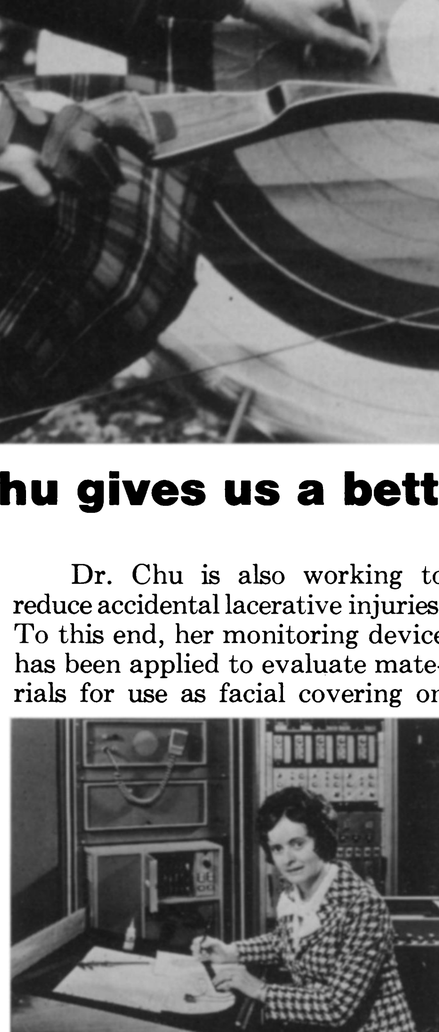
Dr. Billie Mae Chu gives us a better aim at safety.

Working at the busy Research Laboratories at the G. M. Technical Center in Warren, Michigan, Dr. Chu advances scientific knowledge of skin injuries.

She has developed an instrument which measures elastic properties of normal or burned skin. The equipment is also adaptable for measuring properties of synthetic substitutes for skin.

This device can be applied painlessly and with no damage to the skin. It has been used effectively to monitor maturing scars of burn patients at the Rancho Los Amigos Hospital in California.

Dr. Chu is also working to reduce accidental lacerative injuries. To this end, her monitoring device has been applied to evaluate materials for use as facial covering on



crash test dummies. These anthropomorphic dummies must simulate human responses as realistically as possible.

It is a demanding, yet fulfilling, task to help reduce the effects of past and potential injuries. Away from work, Billie Mae occasionally relaxes with her hobby of archery.

Her research work in G. M.'s Biomedical Science Group includes instrumentation, testing, writing and consultation. She's one of those special individuals who make life better for all of us.

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Stars and Atoms The molecules and atoms we have here on earth are made up of large volumes of space flecked with tiny dots of matter. For example, if you were sitting in the top row of a large football stadium (e.g., the Los Angeles Coliseum), the upper tier of seats would represent the orbit of a marble-sized electron. The atom's nucleus would be a BB sitting on the fifty-yard line. Everything in between the two would be empty space.

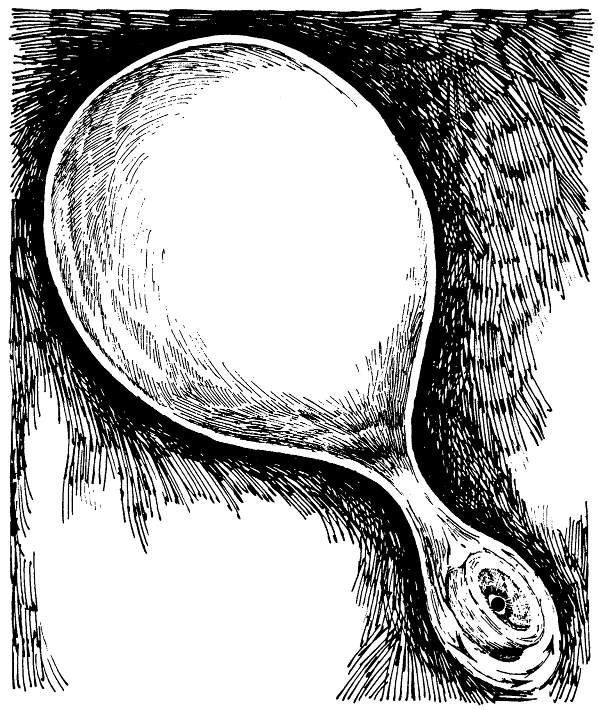
In the interior of stars, matter can be much more dense. For example, when a large star runs out of hydrogen fuel, the immense forces of gravity which have been held at bay by thermonuclear burning within the star suddenly become dominant. As Fred Hoyle puts it, the star has to pay all of its back gravitational taxes at once. The forces of this violent, almost instantaneous collapse are sometimes so great that the electron whizzing around the stadium is driven into the BB sized nucleus on the fifty-yard line. The two opposite charges cancel one another to form a neutron. Then, under the crushing force of gravity, the entire stadium fills up with marble-like neutrons.

Matter of this density exists in the heavens in the form of neutron stars or pulsars. In effect, pulsars are giant atomic nuclei in which the interatomic spaces of matter here on earth have been spectacularly reduced by gravitational collapse. We can learn about the structure of matter in such stars from the high energy radiation they emit.

Imagine now a stellar collapse so violent that the marble-like neutrons themselves are smashed together by the gravitational crush. The matter produced by such a collapse is unimaginably dense. The gravitational field of the resulting stellar object is so intense that no light (or any other kind of radiation) can escape its surface. Hence it is called a black hole. If you shined a flashlight directly on a black hole, you would see nothing for the photons of light would be sucked down its gravitational drain, never to return to your eye.

While black holes cannot be observed directly, their effects on stars unfortunate enough to be near them can be seen. Cygnus X-1 (see illustration) contains the first black hole tentatively identified. The hole is an invisible but dominant component of a binary pair of stars. It is sucking the material of its visible companion into a rotating disk. The violence of the transfer and shredding action heats up the atoms being sucked out of the visible star until they emit x-rays near the black hole, thus indirectly revealing its presence.

Today many physicists are interested in astronomy because much that we have to learn about the fundamentals of matter and energy can only be learned from the stars. That is why TRW Systems is building the High Energy Astronomy Observatory (HEAO) for NASA. The information this observatory will gather beginning in 1977 may well cause us to revise major portions of contemporary physics.



Cygnus X-1. Kip Thorne of the California Institute of Technology performed calculations leading to this model of the black hole. Our illustration is based on a painting of his model by Lois Cohen of the Griffith Observatory.

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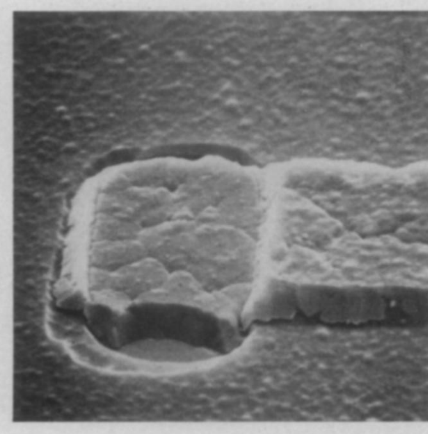

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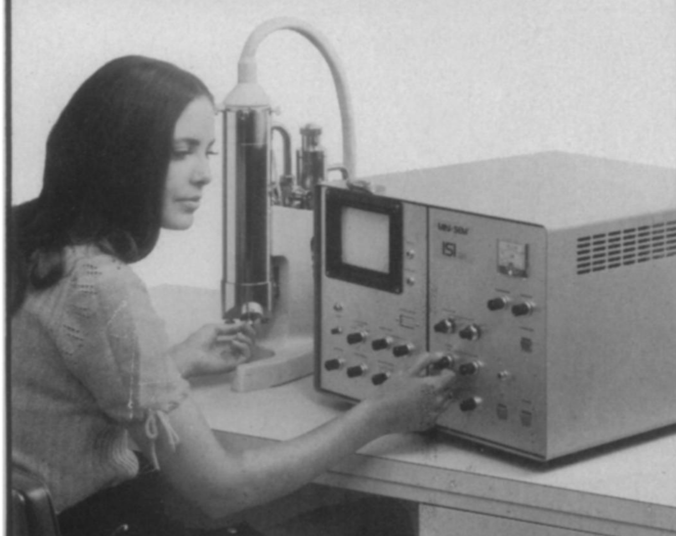

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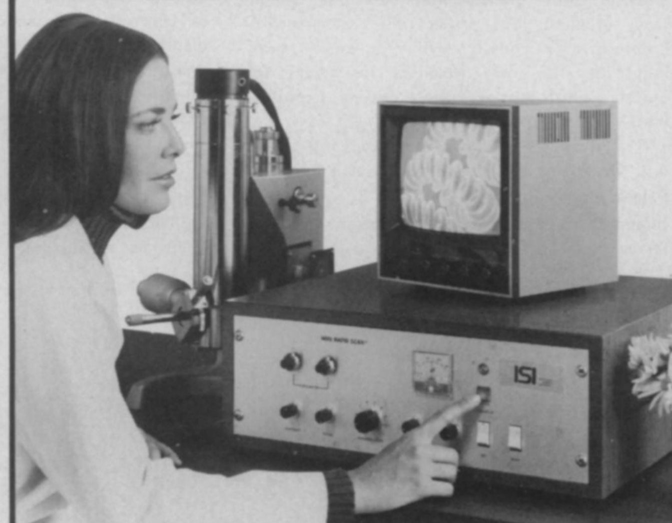

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